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REPORT
ON
SEED MULTIPLICATION SCHEMES
(INDIA)

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COMMITTEE ON PLAN PROJECTS
(Seed Multiplication Team)
1961

LETTER OF TRANSMITTAL

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Committee on Plan Projects,
Planning Commission.
Sudarshana Guest House,
Bangalore-1.
October 31, 1961.

SUBJECT :—Report of the Seed Multiplication Team, Committee on Plan Projects for All India.

Dear Shri Shastriji,

I have great pleasure in forwarding to you the All India Report prepared by the Seed Multiplication Team, Committee on Plan Projects.

This Report deals with seed multiplication for India as a whole based on detailed studies of the Team in eight States, supplemented by a large volume of information obtained from the Agricultural Departments of the other States. Seed Scheme when effectively enforced and the entire area under these crops is saturated with improved seed, can by themselves increase production by 10 to 15 per cent in different crops and this should mean a potential increase in all India production of 7½ million tons of cereal and 1½ million tons of pulses. The objective of the Team is to suggest measures to gain this end in a period of five years.

The study of the Team reveals that seed distribution in India falls far below the programmed target and that the quantity of seed actually distributed is only 21 to 25 per cent of saturation requirements for the major food crops such as rice and wheat and much less for other crops. Even though seed distribution programme for important cereals has been in progress in India for over 40 years, the coverage by improved varieties was only 50 per cent in wheat, 42 per cent in *ragi*, 34 per cent in rice and *jowar* and very much less for other foodgrains. The Team has, therefore recommended highest priority for a more extensive distribution programme of improved seed in food crops.

The programme of establishing State Seed Farms by the Ministry of Food and Agriculture in co-operation with the States, should make available sufficient quantities of Foundation seed to meet the requirements of each C.D. Block or region. But, the total number of targeted Seed Farms have not been established and even the established ones have not all gone into full production, so that the target set is yet to be realised.

In this Report, the Team has suggested measures to implement a full scale distribution programme in all States. It has emphasized the need for comprehensive State-wise trials of different varieties of crops which can help to reduce the number of varieties recommended for growing by farmers and this is one of the important steps by which the maintenance of purity of crops could be effectively brought about. Since it is by research that new and more beneficial varieties could be produced, the necessity for strengthening research particularly in some crops which have hitherto not received sufficient attention, has been emphasized.

With increasing decentralization of our administrative set-up, schemes for the increased production of crops should legitimately be transferred to the control of village *panchayats,* since it is the cultivator in the villages who will benefit by growing improved seed of crops. Special attention has been drawn in the Report to the importance of decentralizing seed work taking each village as a unit and entrusting the work of multiplying and distributing seeds to village *panchayats* through Registered Growers called *Gramsahayaks.*

The Report has been sent to the Ministry of Food and Agriculture and to the Agricultural Division, Planning Commission for obtaining their comments, and the latter has replied that they have no remarks to make. The comments* when received from the former, will be appended to the Report.

With best regards.

Yours sincerely,

R. NAGAN GOWDA

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Shri Lal Bahadur Shastri,
Minister for Home Affairs,
Government of India,
and Chairman, Committee on Plan Projects,
New Delhi.

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*This Ministry have since intimated that the Ministry is generally in agreement with the recommendations made by the Team but detailed comments could be offered only after the examination of the recommendations in detail by Ministry's Standing Expert Committee on Seeds, *vide* Appendix VIII.

PREFACE

The Seed Multiplication Team was appointed in May 1960 by the Committee on Plan Projects, Planning Commission. The Terms of Reference were to make an appraisal of the Seed Multiplication Schemes in India, with particular reference to the sufficiency of the programme, comparative economics of various types of Seed Schemes, effectiveness of distribution arrangements, priorities and phasing of the programme, and suggestions for improvement. The Team visited the States of Madhya Pradesh, Madras, Mysore, Maharashtra, Himachal Pradesh, Rajasthan, West Bengal and Punjab and after a detailed study of the work of seed multiplication and distribution in these eight States has prepared separate Reports for each of the above States.

The Report deals with seed multiplication for India, as a whole, based on detailed studies of the above eight States, supplemented by a large volume of data supplied by the Agricultural Departments of all States in India. Seed Schemes are very important in India, as they can by themselves increase production by 10 to 15 per cent in different crops, and this should mean a potential increase in all-India production of 7½ million tons of cereals and 1½ million tons of pulses, if the entire area under these crops can be saturated with improved seed. The objective of the Team is to suggest measures to gain this end in a period of five years.

A noticeable feature of seed distribution in India is that it falls far below the programmed target and that the quantity of seed actually distributed is only 21 to 25 per cent of saturation requirements for the major food crops such as rice and wheat and much less for other crops. Even though seed distribution programme for important cereals has been in progress in India for over 40 years particularly for important cereals, the coverage by improved varieties of crops was only 50 per cent in wheat, 42 per cent in *ragi*, 34 per cent in rice and *jowar* and very much less for other foodgrains. It is only in sugarcane (89 per cent) and cotton (75 per cent) that the coverage has been substantial. The Team has therefore recommended highest priority for more extensive distribution programme of improved seed in food crops.

The programme of establishing State Seed Farms in the Second Five Year Plan by the Ministry of Food and Agriculture in co-operation with the States, should make available sufficient quantities of Foundation seeds to meet the requirements of each C.D. Block or region. Though these farms have not yet reached their full production potentials, they have justified their establishment for, the total increased production in the last two years of the Plan was of the order of 8 lakh tons of foodgrains. But the total number of targeted

Seed Farms have not yet been established and even the established ones have not all gone into full production so that the target set is yet to be realised.

In this Report, the Team has suggested measures to implement a full scale distribution programme in all States. The Team has emphasized the need for comprehensive State-wise varietal trials of different strains of crop which can help to reduce the number of varieties recommended for growing by farmers. Since it is by research that new varieties can be produced, the necessity for strengthening research particularly in some crops which have hitherto not received sufficient attention has been emphasized.

With increasing decentralisation of our administrative set-up, schemes for the increased production of crops, should legitimately be transferred to the control of Village *Panchayats,* since it is the cultivator in the villages who will benefit by growing improved seeds of crops. The activities of the seed multiplication schemes need some reorientation and change of emphasis. In the Third Five Year Plan, the main task of the Agricultural Department would be to convince the cultivators in the villages that increased yields can be obtained by the use of improved seeds and that a crop can be ensured against certain diseases by the use of disease resistant varieties. Increasing the yield per acre is the only practical solution for our mounting population. Since our present crop yields are generally the lowest in the world, the margin of possible increase is obviously the highest. The achievement of the *Krishi Pandits* have already demonstrated this.

Obviously the effective way of creating active interest on the part of the farmers is for the Agriculture Department to carry out demonstrations in the villager's fields, thereby imparting the techniques of improved agricultural practices. As is well-known, a cultivator feels more justified in following the practices of a *Krishi Pandit* than of the best scientific expert on the subject. The active co-operation of *Krishi Pandits* should be enlisted for establishing maximised production plots for different crops, first in the Block areas and later in individual villages. Special attention has been drawn to the importance of decentralizing seed work taking every village as a unit and entrusting the work to village *Panchayats* by distribution of seeds through Registered Growers called *Gramsahayaks.*

Our thanks are due to all the State Governments for providing facilities which made the compiling of this Report possible. The Team also expresses its appreciation of the valuable help rendered by the several Directors of Agriculture by the supply of useful data.

The proposals of the Team for strengthening the existing staff for seed work have been made on its observation on the present position and which in its opinion is not sufficient to gain the objective of increasing production all over the country through an organised programme of supply of good seed. Though the proposals have been made with the concurrence of the Governments of some of the States they are subject to further examination which the Committee on Plan Projects may decide in consultation with the State Governments. It has been indicated in this Report, where such an examination might be useful.

The Team records its appreciation of the very valuable help rendered by Dr. K. Ramiah, Adviser to the Team, in all stages of its work and in the preparation of its many Reports and also its appreciation for the drafting of two of its Reports and for the general assistance rendered to the Team by Dr. Arjan Singh, Adviser.

Dr. R. Nagan Gowda
Leader

Thakur Phool Singh
Member

Shri Boshi Sen
Member

Dr. B. P. Pal
Member

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CHAPTER I

SUFFICIENCY OF THE IMPROVED SEED PROGRAMME IN INDIA

Seed Requirements

1.1. The area in India under different crops, their productio and requirements of seed for the year 1959-60 are given in Table The seed requirements have been estimated for each crop from th different seed rates adopted under irrigated and rainfed conditions i each State.

TABLE I

Area, production and seed requirements of important crops in Indi

Crop	Area ('000) Acres	Production ('000) Tons	Seed requi ments ('oo Tons
Cereals			
Rice	91,343	29,330	1,772
Wheat	31,500	9,734	1,108
Jowar	41,602	7,866	169
Maize	10,457	3,615	47
Bajra	26,699	3,484	72
Barley	8,220	2,605	219
Ragi (Nagli)	6,211	1,860	20
Small Millets	12,340	2,012	44
Pulses			
Gram	25,046	5,390	447
Arhar	5,843	1,589	39
Other Pulses	28,883	4,257	
Oilseeds			
Groundnut	15,305	4,390	547
Rape & Mustard	6,211	1,037	16
Linseed	3,921	425	18
Til (Sesamum)	5,510	392	12
Castor	1,178	108	3
Other Oilseeds	2,870	290	13
Others			
Sugarcane	5,178	68,500 (Cane)	7,767 Sett
Cotton	19,252 (Seed)	1,370	100
Potato	702	1,684	312

The quantities of seed required are high in rice with 1.77 millio tons, wheat with 1.11 million tons, groundnut 0.55 million tons an gram 0.45 million tons. Annually about 35 lakh tons of cereals, 5 lakh tons of pulses and 6 lakh tons of oil seeds are utilised in India. The object of seed schemes is to replace the existing seeds by seeds of improved varieties, which are estimated to give a 10 to 15 per cent increased yield in most crops. The potential increase can be about 75 lakh tons in cereals and 12 lakh tons in pulses if full saturation of the area with improved seeds can be effected. Use of hybrid maize seed has given even 90 per cent increase in production which means some 25 lakh tons of additional foodgrain.

The benefit to be derived by growing improved varieties is also influenced by the treatments given to crops. Improved varieties have been evolved which respond to good fertilization of soil and irrigation and under those conditions the increase in production due to growing of much improved varieties can even be higher.

Relative importance of the States in different crops.

1.2. In *Appendix I* are given the areas under crops and the proportion irrigated in each State. The utilization of irrigation resources for crops varies considerably in the different States. In India, the area irrigated was 68 per cent in the case of sugarcane, 40 per cent in barley, 35 per cent in rice, 31 per cent in wheat, 15 per cent in *ragi*, 12 per cent in maize, 10 per cent in cotton and only 1 to 3 per cent in groundnut, *jowar, bajra* and pulses. Considering individual States, while 90 per cent of the rice area was irrigated in Andhra and Madras, it was only 50 per cent in the Punjab, 30 per cent in Bihar and Assam and only 10 per cent in Uttar Pradesh. In wheat about 50 per cent of the area was irrigated in the Punjab, Rajasthan and Gujarat, 14 per cent in Maharashtra and Bihar and only 4 to 6 per cent in the relatively large growing areas of Madhya Pradesh and Uttar Pradesh. In *jowar* the percentage of the irrigated area was about 25 in Madras and Punjab and negligible in other States. This is even more true of *bajra* where one-fifth of the crop was irrigated in Madras. one-eighth in the Punjab and negligible in other States.

Adequacy of the planning of seed programme

1.3. We have noted that there are variations in the methods employed for planning seed Programme in different States. When the State Seed Farms were started, some States such as Madras, Maharashtra and Mysore adopted a phased programme to saturate the area of crops in a specified period of years. In Mysore the period was taken as four years, in Maharashtra five and in Madras three for rice and millets. In some other States, the target for saturation was 10 years and in still others no period was prescribed. In most States, the plan as drawn up was only for the most important cereals and millets, such as rice, wheat, *bajra* and *jowar*. Generally small millets and pulses were not included in the Seed Plan. By the end of the Second Five Year Plan period, the necessity was felt to include groundnut and other crops. In some States saturation aimed at was for only a portion of the area of each crop determined by the availability of the improved varieties. The Team is of the opinion that seed work should be extended to all the important crops in the Third Five Year Plan and recommends that the States which have not yet drawn up a full programme should do so to cover the total area of all important crops with improved seed once in five years and that arrangements should be made to establish Seed Farms to provide the necessary foundation seed. The Team also recommends that the minor millets and pulses which occupy a large area should also receive attention at least in cases where improved varieties are already available.

Methods of planning Seed Multiplication

1.4. (a) *Period of saturation* : For the purpose of this Report a reasonable period by which the whole area of a crop is to be saturated with improved seed is taken as five years as in most States, and this is done by distributing enough seed to cover one-fifth of the area every year. For the first generation of hybrid maize seed, *bajra* and *jowar,* annual supply of the total requirement should be aimed at.

(b) *Multiplying rate and class of Registered Growers* : The programme of seed multiplication has to be modified according to the multiplying rate i.e., the seeds to be used divided by the seed rates and the number of classes of Registered Growers. This rate is high in the case of *bajra, ragi, til* and rice and low in the case of wheat, gram and cotton. The rate is also much higher for irrigated and transplanted crops than for rainfed or broadcast crops.

It is not generally realised that when Foundation Seed is multiplied by a Registered Grower, only a certain portion of the produce is available for seed. A Madras survey revealed that the average paddy grower parts with only 40 per cent of his produce for seed. In the Punjab, many Registered Growers said that they are in a position to give almost the entire production. For purpose of this Report, it is assumed that on the whole a Registered Grower can release for seed only half of his produce.

In *Appendix II* are given the crop area that can be saturated once in five years by one acre of a Seed Farm, with different multiplying rates and with one class 'A' or two classes 'A' & 'B' of Registered Growers and with 50 per cent of the production distributed as seed. With a multiplying rate of 10, one acre of Seed Farm can cover in five years only 250 acres of general crop with one class of Registered Growers, and 1,250 acres with two classes. With a multiplying rate of 30, one acre of seed farm can cover 2,250 acres even with one class of Registered Growers.

In the large majority of irrigated crops and in many of the rainfed crops it is possible to saturate one-fifth of the total area every year in *bajra, ragi jowar,* rice, linseed, rape and mustard, *til* and castor. The Team, therefore, considers that as far as possible there should be only one class of Registered Growers and wherever one more class is introduced, their number must be kept as low as possible and they should be located adjacent to the Seed Farms so that proper supervision could be exercised.

The difficulty for saturation with improved seeds mainly occurs in the case of rainfed crops of wheat, cotton, groundnut, potatoes and gram. Where the rainfed area in a State under the crop is large, it will not be possible to saturate it once in five years with one class of Registered Growers. Thus 10 lakh acres of rainfed crop with a multiplying rate of 10 will require 4,000 acres of the crop in the Seed Farm. But with one more class of Registered Growers 200 acres will be enough. There are many States which have 20 to 30 lakh acres under rainfed crops of gram, groundnut and cotton. In such cases, the necessity to have more than one class of Registered Growers is inevitable and has to be adopted. Even here, the number of classes should not exceed two.

The Team considers that a reasonable rate of multiplication from one acre of Seed Farm to the general crops once in five years should be at least 1,000 and 2,000 will be more desirable. In the Punjab, the problem in wheat has been solved by growing the crop under irrigation both in the State Seed Farms and in the land of the Registered Growers. In any case the Team also considers that it is not necessary to increase the number of classes beyond two and wherever necessary the area of the Seed Farm should be suitably increased. Thus, with 2,000 acres under the Seed Farms, 28, lakh acres can be saturated in five years with two stages, even with so low a multiplying rate as eight.

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(c) *Planning of seed multiplication in the States*: The Team has examined the seed plan in several States. The seed rate for paddy used is as low as 20 lbs. in the transplanted areas of Mysore, Maharashtra and Punjab, and as high as 60 to 80 lbs. in Madhya Pradesh and Kerala for the broadcast crop. In Uttar Pradesh the seed planning for cereals is based on a multiplication rate of 10. In Madhya Pradesh two classes of Registered Growers are utilised for multiplication of paddy seed. The Team noted that to saturate 10 lakh acres of paddy in five years, 3 to 40 tons of nucleus seed are required in the different States with average yields. This shows the scope for making seed multiplication efficient by economising seed rate and increasing production per acre of seed areas. The Team, therefore, recommends that in State Seed Farms adequate provision for supply of manure and irrigation should be made for maximising production. Furthermore, the seed rate should be reduced to the minimum by transplantation as in paddy or by line sowing.

(d) *Effectiveness of planning arrangements*: The Team considers that the State plan should be followed up in every unit of the State, whether it is Community Development Block, a district or a taluka.

In Maharashtra, for example, the multiplying rate from one acre of Seed Farm to the general area once in five years is taken as follows :—

Crop	Multiplying rate of one acre of Seed Farm to general crop
Paddy	3,200
Ragi	1,200
Bajra	70,000
Jowar	5,000
Wheat	400
Gram	300

This rate is followed right down to the smallest unit in each taluka determining the seed farm area of each Taluka Seed Farm on that basis. In other States, due to difficulties in acquiring land the size of the State Seed Farms vary and in some States unassigned Government lands are utilised for Seed Farms as in Rajasthan. The Team recommends that in States where the present area is inadequate, sufficient area for State Seed Farms should be acquired or reclaimed to produce enough seed which when multiplied can cover annually one-fifth of the area of all important crops in the Third Plan period.

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CHAPTER II

RESEARCH

Agricultural Research Stations

2.1. The number of Agricultural Research Stations in the States varies considerably. There are 73 including College and School Farms in Maharashtra, 52 in Andhra, 45 in Mysore, 37 in Uttar Pradesh, 27 in Madras, 10 in Rajasthan, 52 in Madhya Pradesh and 24 in West Bengal and 500 for the whole country. The pattern for crop research work in Maharashtra and Madras is to have a Crop Specialist for each important crop with a main station and a number of sub-stations one for each important region. In other States, there is usually one Economic Botanist, with Assistant Botanists one for each important crop, as in Madhya Pradesh, West Bengal, Punjab and Himachal Pradesh. The Team considers that for all important crops in a State there should be a separate Crop Specialist devoting his entire attention to the crop with a central and a number of regional stations where all aspects of research, breeding, agronomy, crop protection etc., could be undertaken. In larger States where there are a large number of Crop Specialists and other technical officers it should be useful to have a Joint Director of Research and Education and usually the Principal or Dean of the College functions in that capacity which can be considered equally satisfactory.

Sufficiency of Breeder's Seed Programme in India

2.2. *Number of improved varieties*: The total number of improved varieties of crops in India now being multiplied is given in Table II. Allowing for some of these varieties which are multiplied in more than one State, the net number is also given along with the total number under each crop.

TABLE II

Number of improved varieties in India.

Crop	Gross	Net after allowing for varieties grown in more than one State	Average per State	Number of varieties for million acres (Net)
Rice	413	379	22	4·6
Wheat	116	89	6·0	2·8
Jowar	89	85	4·5	2·1
Bajra	25	24	1·3	0·9
Ragi	34	31	1·7	5·0
Maize	18	16	0·9	1·5
Barley..	16	16	0·8	1·9

TABLE II—(*contd.*)

Crop	Gross	Net after allowing for varieties grown in more than one State	Average per State	Number of varieties for million acres (Net)
Tenai (Kora)	8	8	0·9	1·3
Other Millets	11	11		
Gram	22	19	1·3	0·9
Tur	17	17	0·9	3·0
Mung	13	11	1·9	—
Urad	9	9		
Other Pulses	14	14		
Groundnut	52	37	2·6	2·4
Castor	17	17	0·9	1·4
Til	15	13	0·7	2·4
Linseed	11	11	0·6	3·0
Rape & Mustard	2	2	0·1	0·3
Other oilseeds	11	11	0·6	—
Cotton	68	47	3·4	2·5
Sugarcane	68	47	3·6	9·0
Potatoes	12	11	0·6	14·2

It will be seen that over 910 improved varieties are multiplied in India, the largest being in paddy, next in order are wheat, *jowar*, cotton, groundnut and sugarcane. Research has been most intensive in the above crops. It will be noted that the number of varieties in many crops such as *bajra*, maize, barley, minor millets, minor pulses, castor, *til*, linseed, rape and mustard, is hardly one to two per State and not adequate to cover the whole area. The Team, therefore, recommends intensification of breeding in these crops particularly in minor millets and minor oilseeds so that their production can be increased by growing improved varieties.

Number of improved varieties in the States and their potential coverage.

2.3. The number of improved varieties of different crops multiplied in each State is given in *Appendix III* and the breeding programme for each crop is discussed below.

1. *Rice*: In rice, the number of varieties multiplied is relatively large in some States, 79 in Andhra, 58 in Mysore, 41 in West Bengal, 38 in Madras, 32 in Maharashtra and 31 in Kerala and Orissa. To make Seed Schemes efficient and to maintain quality control, the Team considers that a reduction in the number of varieties is both necessary and feasible. As at present, the number of rice varieties multiplied for every million acres is 25 in Mysore, 16 in Kerala, 11 in Andhra and Maharashtra and 10 in the Punjab. While it is recognised that a certain amount of multiplicity of varieties is inevitable because of water facilities, seasonal variations, variation in maturity periods, quality and market requirements the Team recommends that steps should be taken to reduce this number, particularly in Mysore,

Madras, Maharashtra, Kerala and Andhra. Some measures are already being taken in some States in this regard. It may be mentioned that more than half of the area in some States is covered only by a few important improved varieties. For example, in Madras, 6 varieties were found to account for about 75 per cent of the area under improved rice varieties which shows that there is scope for reducing the present number to a reasonable minimum. The Team recommends that the position regarding the number of rice varieties should be revised in all States and the number reduced to a minimum.

In India improved rice varieties are already available which can cover 80 to 90 per cent of the areas in Madras, West Bengal, Mysore, Maharashtra and Andhra Pradesh. The relatively small areas which need special varieties relate to saline lands, dry areas with limited rainfall, lands subject to intermittent or permanent flooding etc. The Team considers that the immediate needs of the areas could be met by a rapid and simple programme of selection in the local varieties and release of seed, until such time better varieties either by extensive varietal trial or by breeding become available. The co-ordinated breeding programme using *Indica-Japonica* crosses recently initiated will, it is hoped, result in cosmopolitan varieties with a wide range of adaptability.

2. *Wheat* : The large number of rust-resistant varieties evolved by the Indian Agricultural Research Institute and their trial in different areas have shown a high coverage potential comprising large wheat areas in the Punjab, Rajasthan, Uttar Pradesh, Bihar, Bengal and Orissa and to a smaller extent in Maharashtra and Mysore. The need is however for suitable varieties for rainfed conditions for parts of Maharashtra, Mysore and Rajasthan and a hard wheat for the Kotah Division of Rajasthan. With regard to the latter, it may be mentioned that improved rust resistant strains of hard wheat (*durum*) have been recently bred at the Indore sub-station of the Indian Agricultural Research Institute and these would be very suitable for the Kotah region of Rajasthan, the Malwa region of Madhya Pradesh, as also for the *durum* areas in some other States. In Khopli wheat (*dicoccum*), the rust resistant strain, N.P. 200 developed at the Willington (Nilgiris) sub-station of the I.A.R.I. has been released for extensive cultivation in the Nilgiris and Palney Hills in Madras State. The present breeding programmes in the States combined with regular trials of the new varieties from Delhi should meet the requirements. The number of wheat strains multiplied in the States are already too many, 34 in Madhya Pradesh, 16 in Maharashtra, 14 in Gujarat, 12 in Uttar Pradesh and 10 in the Punjab. The Team considers that a wider and systematic trial of existing varieties in these States particularly in Madhya Pradesh can certainly reduce the number and the seed programmes can be made more efficient.

3. *Jowar* : Of the 85 varieties of *jowar* under distribution in India their break-up according to States are 23 in Andhra, 18 in

Madras, 13 in Mysore, 10 in Maharashtra and only a few in others. The varieties belong to two groups, one suitable for the *kharif* and the other for *rabi* season. Even in the States where a large number of varieties are under distribution there are large areas which do not have suitable varieties. There is need for better *jowar* varieties in Madhya Pradesh which has a large area under this crop. In the large States of Maharashtra, Mysore and Madras where the position of improved *jowar* varieties is comparatively better only 80 per cent of the area can be covered with the varieties on hand. The need for suitable *kharif jowar* varieties for Dharwar area in Mysore and Poona Division of Maharashtra and rainfed *jowars* for south Madras may be specially mentioned. The Team, therefore, recommends that a more intensified breeding programme of *jowar* should be undertaken for Madhya Pradesh, Rajasthan and the portions of Mysore, Maharashtra and Madras mentioned above.

In this connection, the Team notes that work in Vivekananda laboratory, Almora, has shown the possibility of obtaining over ninety maunds of grains per acre, using a hybrid milo (Kaffir × 60 Hegari). It should be tested out on a large scale in the other *jowar* areas. Trials with hybrid *jowar* using a male sterile *jowar* as the mother parent have begun and there is an All-India scheme (co-ordinated Sorghum Breeding Project) to be brought into effect in all *jowar* growing States. This offers even greater possibilities than hybrid maize occupying only ninety-five lakh acres compared against the very extensive area under *jowar* in the country (400 lakh acres) that could benefit from this. Work done so far has shown the possibility of releasing in the very near future, hybrid *jowars* giving high yields and good grain quality.

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4. *Bajra* : The number of improved varieties in *bajra* is very small and the coverage potential is also generally small, except in Madras and to some what smaller extent in Andhra Pradesh and Maharashtra. In Madras, eight varieties are under distribution, including three hybrids, and in Gujarat five. Other States have only one or two varieties and few none. In Rajasthan with 100 lakh acres under the crop there are only two varieties. The Indian Agricultural Research Institute has recently released a variety "Improved Ghana" introduced from the Ghana in Africa. This variety has given higher yields than Punjab T. 55 in Delhi and adjoining areas. It has attractive ears and very bold grains. Taking the country as a whole, the breeding programme in *bajra* must be considered inadequate. Research work started several years back in Madras has shown that as in maize, hybrid *bajra* can also be produced and the hybrids give 20—30 per cent higher yields. A scheme is in progress in this State by which 8,000 lbs. of hybrid seed are produced every year enough to plant 1,200 acres. With more land facilities the production of hybrid *bajra* can be very much increased.

The Team recommends that the scheme of producing hybrid *bajra* as well as improved varieties in this crop should be undertaken.

In such States as Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, Mysore and Andhra Pradesh where *bajra* is an important crop and the programme should prove particularly valuable in Rajasthan which should have a main Research Station for this crop.

5. *Maize*: With 95 lakh acres under this crop in India, there are 16 improved varieties of which a good number are hybrids. Many States have only one or two improved varieties except Andhra with six and the Punjab three. It is not possible to estimate how much area the hybrids can cover, as most of these belong to the dent type and not popular with the Indian farmers who prefer flint types. There is an All-India project in progress with a number of Central and Regional stations where hybrid maize seed suited to different areas is produced. Hybrid maize offers the best solution for increasing production in this crop. An increase in yields ranging from 80 to 120 per cent has been obtained. The recent trials of the Vivekananda Laboratory (V.L.) flintish hybrids No. 54 and 45A at all Research Stations of the Co-ordinated Maize Scheme of the I.C.A.R. show that their yield potentials do not significantly differ from the highest yielding U.S.A. dent types. The Team suggests that the testing of suitable hybrids available with the Co-ordinated Central Maize Scheme has to be extended to all areas so that the full potentialities of this project can be realised. It may be mentioned here that some American hybrids of maize such as N.C. 27, Texas 26 and U.S. 13 gave very high yields of grain, when tested in India as compared to the local open-pollinated varieties. But, except perhaps for U.S. 13 which can be more or less successfully produced in Jammu and Kashmir and generally in the northern hills, the other American maize hybrids did not prove a success owing to their late maturity and dent type grains and also because of the fact that the inbred lines of these hybrids are susceptible to diseases and are generally unadapted to Indian conditions. It was therefore very necessary to produce hybrids of the desired maturity period and possessing flint type grain. It is gratifying to note that the intensive research on hybrid maize carried out recently in the country under the Co-ordinated Hybrid Maize Breeding Scheme in co-operation with the I.C.A.R. the Rockfeller Foundation and the States has resulted in the production and release of four flint-type hybrids which could now be taken up for large scale production in India.

6. *Ragi* (*Eleusine coracana*): Adequate improved varieties of this crop exist in Mysore, Madras and Andhra Pradesh. They can cover the entire irrigated area, and about 50 to 60 per cent of the rainfed area crop, particularly in Madras and Maharashtra. In Mysore, a cosmopolitan strain, Aruna is suited to a large area under rainfed conditions. Most of the improved varieties, 34 in number are grown only in Madras, Mysore and in Andhra Pradesh. There are no improved varieties available for the extensive areas under the crop in Bihar and Uttar Pradesh. The Team, therefore, recommends the undertaking of a breeding programme for *ragi* in Bihar and Uttar

Pradesh and the intensification of breeding in Madras and Maharashtra to produce varieties suitable for rainfed areas.

7. *Barley*: Suitable barley varieties are being distributed in Uttar Pradesh, Punjab and Bihar but there are inadequate number of varieties in Madhya Pradesh, Rajasthan and Himachal Pradesh where a programme of breeding should be undertaken.

8. *Minor Millets*: There are a number of minor millets occupying about 120 lakh acres in India. In Korra (*Setaria italica*) suitable strains exist in Madras, and also in the Andhra Zone of Andhra Pradesh, but not in the Telangana or Hyderabad Zones. Except in Madras, where one or two varieties for each of the minor millets are multiplied, there is practically no work done on these minor millets elsewhere and the number of improved varieties evolved is negligible.

9. *Gram*: The number of improved varieties of gram grown in India is 19, of which 8 are distributed in Madhya Pradesh, 5 in the Punjab and 4 in Gujarat, but the number is no indication of the coverage, except in Punjab, where 80 per cent of the area is reported to be covered by improved varieties. The variety *'chaffa'* is popular in the three States of Mysore, Maharashtra and Gujarat. In Madhya Pradesh, in spite of the eight improved varieties, the coverage is very small. The Team noted that a number of disease-resistant hybrid derivatives are under trial in Mysore. Because of the importance of the crop a more intensive programme of trials of existing varieties as well as breeding of new varieties by selection and hybridization is called for. It is hoped that this would receive attention in the Third Five Year Plan period.

10. *Pulses*: A few improved varieties of tur (*Cajanue cajan*) are under distribution in Uttar Pradesh, Andhra, Mysore and Gujarat and the total number tested is 17. A few varieties resistant to the wilt disease of *arhar* (*tur*) have been developed at the Indian Agricultural Research Institute and in Maharashtra and Andhra Pradesh. The coverage potential is however small, except in Uttar Pradesh, Madras and Mysore. *Tur* being a crop comparatively more cross-pollinated than the other pulses, a more frequent renewal of seeds would be necessary. It occupies an important place in the economy of the country particularly in the States of Uttar Pradesh, Andhra, Mysore and Madras. The Team therefore recommends a more intensive programme of research for *tur* in these States, and the production of sufficient Breeder and Foundation seed to provide for an extensive distribution programme.

There are 11 varieties of *mung* (*Phaseolus mungo*) and 9 of *urad* (*Phaseolus aurous*) distributed in India with one or two in each of the States in the case of *mung*; but the production of Breeder's seed and Foundation seed is small and actual distribution negligible. In *urad* only four States have evolved improved varieties, and there is need for more. In the case of several other pulses improved varieties evolved are only a few, and are limited to some of the States only. Considering that all these pulses, including *mung* and *urad* occupy 290 lakh acres in India, the Team recommends that more suitable varieties should be evolved of these pulses to provide the much-needed protein in the diet of the major part of the population; while the best of the available varieties should be multiplied and distributed until new varieties become available.

11. *Groundnut*: About 52 varieties of groundnut are distributed in the different States of India, of which 13 are multiplied in more than one State. The number of varieties (18) appears high in Maharashtra, and it should be possible to reduce this number by extensive trials. There are nine improved varieties each in Gujarat and Mysore and four each in Madhya Pradesh and Madras. It is only in Maharashtra, Madras and Mysore that the existing varieties can cover the bulk of the area. Some of the improved varieties such as *Small Japan,* which has a small-sized nut are not popular. In the spreading type of groundnut, the seed has a dormant period and cannot be used for sowing immediately after harvest. Because of this difficulty the crop cannot be grown out of the season and the produce used as seed in the regular season. As the multiplying rate for the rainfed crop is also low a breeding programme is necessary not only to obtain better yielding varieties but also to overcome dormancy. The crop is seriously subject to the *Tikka* disease (*Cercospora sp.*) and breeding of resistant varieties is particularly important for Mysore and Madras. Work in progress in this line at these States needs intensification. This crop offers difficulties in procurement as it is often sold immediately after harvest to avoid losses in storage, and needs special facilities such as large areas under nucleus seed in Zonal Nucleus Farms or Agricultural Research Stations and also large blocks of State Seed Farms to multiply the Nucleus seed. Unlike in other crops the production of Registered seed has to be in two stages *i.e.* by 'A' and 'B' Class Registered Growers as otherwise the expansion of coverage is bound to be slow.

12. *Other Oilseeds*: There are now under distribution 15 improved varieties of *til,* 17 of castor, 11 of linseed and two of rape and mustard. At the Indian Agricultural Research Institute several rust and wilt resistant strains have been developed in linseed and these have been found suitable for release in Delhi, Rajasthan, Uttar pradesh, Madhya Pradesh and Bihar. One such strain has been produced in the Punjab. Although, these crops are easily multiplied due to the low seed rate, production of the Nucleus seed is small. It would appear that in Andhra Pradesh the existing varieties of castor, *til* and linseed can cover a large area, except in Telangana if a regular multiplication programme is taken up and the Team therefore recommends that this should receive attention. Rape and mustard occupy 70 lakh acres. Botanical research in these crops used to figure in the programme of work in Punjab and Uttar Pradesh. Perhaps it needs further intensification.

13. *Cotton* : In cotton the existing improved varieties can cover practically the entire area in the important cotton States. A large number of breeding schemes jointly financed by the Indian Central Cotton Committee and the States concerned have been in progress for several years and there are now 47 improved varieties under distribution, of which about 27 are *hirsutums* (American) including a large number of hybrid origin. Many of the improved varieties (11 American and 10 *desi*) are popular in more than one State. Outstanding results have been achieved in Madras, Punjab and Maharashtra with improved American types giving 1/10″ staple and 45 to 50 counts spinning value. Good results have also been obtained in Punjab, Gujarat and Mysore. *Desi* hybrids, capable of spinning 25 to 35 counts with good yields, have been evolved in many States. There is also promise of new selections still superior to established good varieties coming out of the work in progress. Small pockets of uncovered areas still exist in Madras and Andhra Pradesh. India is short in supply of the highest quality cotton spinning over 80 counts. This can be met if the work on Sea Island cotton should succeed. The results of acclimatising Sea Island cotton are variable ranging from very low yields due to the *blackarm* disease to as high as 1,600 lbs. *kapas* in parts of Mysore. The work is important and the Team feels that it should be continued to exploit fully the possibilities.

14. *Sugarcane* : With the availability of good selections coming out of the Central Research Station, Coimbatore, the progress in the multiplication of improved varieties of sugarcane has been very satisfactory in all the States. There are 47 varieties including 22 from U.P. under distribution in India and some of them such as CO's 419, 449, 527, 312 and 313 are popular in more than one State. Although in most States the improved varieties have saturated the whole area and give satisfactory tonnage under good conditions the sugar recovery is still low and there is need to increase the output of sugar per acre. It is expected that greater attention will be paid to this in future research programme.

15. *Potatoes* : Except in parts of Uttar Pradesh, Bihar and Himachal Pradesh, most of the varieties grown are improved varieties, but some of them e.g., *Great scot* in Madras have not been replaced by new varieties for a long time. The Central Potato Research Institute at Simla evolves varieties for most of the hill areas and the plains, but there are difficulties in renewing crop grown in the plains with disease-free seed material. It is also reported that some of the varieties from Simla are not suited to the plains, as in Maharashtra or Mysore, where there is a preference for hard varieties. Recently the late blight disease had occurred on a large scale in the Madras Potato area. Generally virus diseases spread rapidly in the plains and renewal with disease-free potato seed from the hills has to be a continuous process. Seed from the crop grown in the plains can be used only once. As this crop is an important supplementary food in the country, the Team recommends that breeding should be intensified to meet the

varying requirements of States in the plains including evolution of hard and disease resistant varieties. There should also be an organised supply of certified seed to the importing States under the control of the importing State departments such as Mysore and Maharashtra.

Inter-State co-ordination in the supply and distribution of improved varieties.

2.4. As stated earlier many improved varieties of crops are utilised in more than one State and a list of the more important of these is given in *Appendix IV*. There are 24 such varieties of rice, 9 of wheat, 7 of groundnut and 12 of cotton besides thirty for all other crops. Some of them are grown in contiguous areas of adjoining States and there are also other with a high coverage in many States. In rice the variety S.R. 26B is grown in six States, GEB 24 and *Basmati* 370 in four States and Cross 21, T. 21, CO 25 and CO 3 in three States. Similarly a few of the introduced Chinese varieties are popular in more than one State.

The improved NP wheat varieties are popular over more extensive areas in many States than in rice. The varieties No's 710, 718, 770, 809, 798 and 829 cater to more than four States each, while C. 591 and NP 718 are popular in as many as six States and HY 65 in four. In cotton there are 12 inter-State varieties, of which the most popular are Punjab 216 F, Sea Island Andrews, Deviraj 170/Co. 2, H. 420 and H. 14.

The groundnut varieties TMV 1, 2 and 3 are popular in Madras, Mysore and Andhra Pradesh, while the variety, Spanish Improved and A.K. 12—24, are suited to Maharashtra, Gujarat, Mysore and Andhra Pradesh. Many sugarcane varieties cover wide areas in several States particularly CO 419, 527, 312 and 313. Even in minor crops, the varieties *China mung* and *Chaffa* gram are inter-State in character and so also T. 85 in sesamum.

The Team considers that there is scope for co-ordination between the States in the multiplication and utilization of varieties of inter-State popularity. Nucleus seed is not available in sufficient quantities in some States as, for example, wheat in Himachal Pradesh and Madhya Pradesh. Such short supply also occurs in the case of some cotton varieties. Even in paddy, seed shortages can occasionally occur due to failure of rains or damages due to floods. The Team therefore suggests that seed schemes of inter-State varieties particularly those of short maturity period could undertake production of larger quantities in the States where they are an important crop with a view to make the seed available to other States when necessity arises and thereby integrate the programme of seed multiplication for the whole of India. The Team also considers that growing of certain day-neutral early maturity paddy varieties such as Ptb. 10 and TKM 6 of Madras which are cosmopolitan in nature, should be encouraged so that they can be used when season is late or when the main crop fails and a short maturity crop is needed.

General Plant Breeding Research in India.

2.5. Plant breeding research in India has made considerable progress in sugarcane, cotton, rice and wheat and to a lesser extent in groundnut and *jowar.* Work that can be considered outstanding refers to cotton in Maharashtra and Madras and wheat in the Indian Agricultural Research Institute, Delhi, sugarcane in the Central Research Institute, Coimbatore and rice in Madras and Andhra Pradesh. The responsibility for evolution and multiplication of improved varieties is mainly the concern of the States. To meet the needs of a fast growing population great emphasis is necessary on the production of foodgrains. For this purpose, research on food crops has to be intensified to produce new varieties suited to varying needs. So far as rice is concerned emphasis has to be for producing varieties with strong straw with greater response to fertilization, that can mature early and that are less sensitive to proto-periods. The greatest need is for varieties of a cosmopolitan nature that can tolerate a wide range of conditions. To achieve the objectives, an intensification of the hybridization programme is needed. There is also need for an All-India co-ordinated trial of selected varieties from different States to determine their cosmopolitan nature. In the case of millets greater attention has to be paid to evolution of strains for rainfed areas. For *kharif jowar,* the first step is for extensive trial of varieties to find out the best fitting types to areas which do not have a suitable improved variety. In wheat, the main problem will be to augment the existing supply of Nucleus and Foundation seed in the Research Stations and Regional Farms of many States and the creation of facilities in comparatively smaller States such as Himachal Pradesh, to produce their own Nucleus seed. The utilization of hybrid seed for increasing food production should get the highest priority in maize as well as in *jowar* and *bajra.* The problem in maize will be the determination of the most suitable varieties by crossing which greatest increase in yield is possible for different areas and in *jowar* and *bajra* the intensification of the existing hybrid programmes. Improvement of varieties of small millets should receive more attention in the Third Five Year Plan, as these are important food crops covering a large area in rainfed tracts.

In cotton, the need is for evolving varieties of greater yields and better quality. Production of hybrids with 1″ staple in rainfed areas and 1¼″ staple in irrigated areas is possible and work should be directed towards this attainment.

In sugarcane the emphasis should be laid on better recovery of sugar as well as higher tonnage in the future research programme. For potatoes, research should be directed to evolving hard starchy types more suitable to the plains and in the continuous supply of disease free seeds.

CHAPTER III

SUFFICIENCY OF THE SEED MULTIPLICATION AND DISTRIBUTION PROGRAMME AND EFFECTIVENESS OF DISTRIBUTION ARRANGEMENTS AT DIFFERENT STAGES

Coverage of improved varieties of crops in India.

3.1. The area covered by improved varieties is an indication of the effectiveness of seed programmes. The data on coverage by improved varieties are regularly recorded and published in the Annual Administration Reports in Madras. Recently, comprehensive sampling surveys have been carried out in this State for paddy, millets and green manures to determine the progress made. Many States do not maintain records of the areas under improved varieties except in cotton. The information provided in Table III below was compiled from data obtained from the State Departments of Agriculture.

TABLE III

Area under improved varieties 1959-60 ('000 *acres*)

Crop	Total area under the crop in India	Reporting States	Total area reported	Estimated area under improved varieties in reporting States	Percentage of area reported as covered by improved varieties
1	2	3	4	5	6
Rice	81,340	Andhra Pradesh West Bengal Himachal Pradesh Kerala Madras Madhya Pradesh Maharashtra Mysore Orissa	60,799	20,540	34·0
Wheat	31,350	Madhya Pradesh Himachal Pradesh Maharashtra Mysore Punjab Rajasthan Uttar Pradesh Orissa	28,996	14,920	50·1
Jowar	41,602	Madhya Pradesh Andhra Pradesh Madras Maharashtra Mysore Himachal Pradesh	35,310	11,680	33·1

1	2	3	4	5	6
Bajra	26,699	Madhya Pradesh Andhra Pradesh Madras Maharashtra Mysore Himachal Pradesh Rajasthan	17,310	3,150	18·2
Ragi	6,211	Andhra Pradesh Madras Mysore	4,240	1,820	42·9
Cotton	19,560	All growing States	19,560	14,660	74·9
Groundnut	15,305	Principal growing States	13,990	2,180	15·6
Til	5,510	Andhra Pradesh Madras Uttar Pradesh	2,180	207	9·5
Castor	1,178	Andhra Pradesh Madras Mysore Uttar Pradesh	1,060	110	10·4
Rape & Mustard	7,167	Assam West Bengal Punjab Uttar Pradesh	4,790	90	1·9
Linseed	3,921	West Bengal Punjab Uttar Pradesh	870	10	1·1
Sugarcane	5,178	West Bengal Bihar Madras Maharashtra Mysore Punjab Orissa	1,519	1,348	89·0
Potatoes	702	Himachal Pradesh West Bengal Orissa	206	104	50·0
Jute	1,707	West Bengal Orissa	899	697	75·0

The reported areas in Table III comprise the entire area of the country under cotton in India, 90 per cent of groundnut, castor and wheat, nearly 70 per cent of rice, *bajra, ragi* and mustard, 50 per cent of jute and 20 to 30 per cent of other crops. They can therefore be considered as broadly indicative of conditions in the whole country. It was reported that 80 per cent of the jute area in West Bengal, 80 per cent of gram in the Punjab, 29 per cent of minor millets in Andhra Pradesh and Madras were under improved varieties. It can be taken that for India as a whole, the coverage by improved strains of minor millets, minor oilseeds and pulses is extremely low. The poor coverage may be due to (i) non-availability of suitable varieties, (ii) the absence of organised schemes and (iii) or both.

From the above table, it will be obvious that the programme of breeding and seed multiplication work of improved varieties of pulses, oilseeds and minor millets in the Third Five Year Plan should be intensified. The Team also recommends that until such time as new high yielding varieties are evolved, the seed multiplication of the available varieties of pulses, oilseeds and millets should be maximised.

In the major food crops, rice, *jowar,* wheat and *bajra,* the coverage by improved strains during 1959-60 cannot be considered adequate from the All-India point of view. The benefit of improved varieties has still to extend to 50 to 70 per cent of the area under these crops. The distribution of seed of improved varieties at least in some food crops has been in progress for nearly 40 years and must have contributed to increased production but the resulting overall benefit cannot be considered commensurate with the needs of the country with its population increasing at the rate of over 2 per cent in a year. The Team therefore considers that seed distribution in food crops must get the highest priority and all States should aim at a full saturation of the area with improved varieties in the Third Five Year Plan period.

Concept of spread of "improved strain".

3.2. In this connection the Team considers that there should be a certain uniformity in the States in the concept of spread of improved varieties. In the pilot survey conducted by the Madras Government, a field was considered to have grown an improved variety only if the seed was replenished from a recognised source within the five-year period before the survey. Recently the Madras Government have reduced this period to three years. There are Growers who have been growing improved strains particularly of rice and wheat for several years. Although theoritically a variety keeps pure for a longer period in self-pollinated crops than in the partially-cross-pollinated crops provided no mechanical mixture takes place. A certain amount of admixture is unavoidable and this increases rapidly under general cultivation with the average Growers. In can be shown that the increase in impurity is much faster by mechanical mixing than by cross-pollination under the same conditions. Thus with 2 per cent natural crossing or 2 per cent mixing, the purity in the 5th generation will be 96 per cent and 80 per cent respectively. The importance of replacement by fresh pure seed is therefore obvious. The Team therefore recommends that (i) improved seeds even of the largely self-fertilised crops such as rice, wheat, gram etc., should be renewed at least once in five years and preferably once in three years, if possible, (ii) in evaluating the area under improved strains, only cases where the seeds have been renewed within the five years of the survey should be taken into account, and (iii) there should be only one class of Registered Growers for producing Registered seed in most cases or at the utmost two in the case of crops where the multiplication rate is low, as in the case of rainfed crops of wheat, gram and cotton.

Survey of the coverage by improved varieties.

3.3. Except in Madras, no survey of coverage by improved strains has been undertaken in States on a random sampling basis. In Madras the results of such surveys have been published for rice and green manure crops, while a survey for millets has just been completed. The Team considers that the method of survey adopted in Madras is helpful and can be improved upon for future surveys. Instead of having one survey for each crop, a single survey for all important crops growing in the same season can be conducted to save time. Taking 2,000 villages as an adequate sample it will be enough if every nth village is sampled on a random basis where $n \, \frac{\text{Total number of villages}}{2{,}000}$

Alternatively one village can be taken as sample for every 5,000 acres of important crops grown for which improved strains have been distributed. Such a survey will give information about all crops with one sampling and it will be enough if it is conducted once in five years to synchronise with the beginning or end of the plan periods. While it is recognised that the figures collected from such surveys will be approximate, it is much more reliable than a rough estimate based on the seeds distributed and allowance made for natural spread.

In each sampled village four holdings can be chosen at random and the proportion of area under the improved strains to the total area of the crop in the holdings can be expressed as a percentage for each district and for the State as a whole. Provision should be made for a choice of alternate holding when any holding sampled does not come under the crops.

The Team recommends that a random sampling survey on the above lines should be conducted in every State by field staff under the guidance of the Statistician, to determine the area under improved varieties of all important crops in a single survey to synchronise with the beginning of each plan period and that the results of such a survey be published. As was done in Madras the information collected should also include the name of the improved variety actually used. The estimate of the coverage by improved strains usually published every year in the Annual Administration reports of the Agricultural Department will perhaps continue but the sampling survey will provide dependable information.

Sufficiency of the Nucleus, Foundation and Registered seeds distributed.

3.4. The quantities of Nucleus, Foundation and Registered seed required to saturate the entire area of each crop once in five years and the actual distribution effected during 1959-60 are given in Table IV for the eight States of Madhya Pradesh, Maharashtra, Madras, Mysore, Himachal Pradesh, Punjab, West Bengal and Rajasthan supplemented by data from other States wherever available.

TABLE IV

Sufficiency of the Nucleus, Foundation and Registered seed distributed (tons) 1959-60

(Eight States Supplemented)

(Targets and Achievements)

Crop	Nucleus Seed			Foundation Seed			Registered Seed		
	Target	Achievement	Per cent	Target	Achievement	Per cent	Target	Achievement	Per cent
Rice	716	1,052	147	18,143	9,983	55	2,51,800	61,201	24
Wheat	940	320	34	12,740	4,491	34	1,99,360	38,686	19
Jowar	29	227	780	1,123	988	90	26,753	3,308	12
Bajra	11	7	70	431	21	5	13,110	1,157	9
Maize	12	—	—	1,408	100	7	21,240	small	
Ragi	3	16	530	150	45	30	3,980	100	3
Barley	280	40	14	3,635	675	16	43,880	4,885	11
Gram	621	77	12	8,211	1,175	14	82,600	5,398	7
Groundnut	459	162	35	4,360	248	5	1,01,700	Left to natural spread.	
Cotton (2 stages)	45	*m.s.s.		7,264	*m.s.s.		26,199	28,006	107 (A&B stages)

*M.S.S. = Multiplied in Cotton Scheme in Stages.

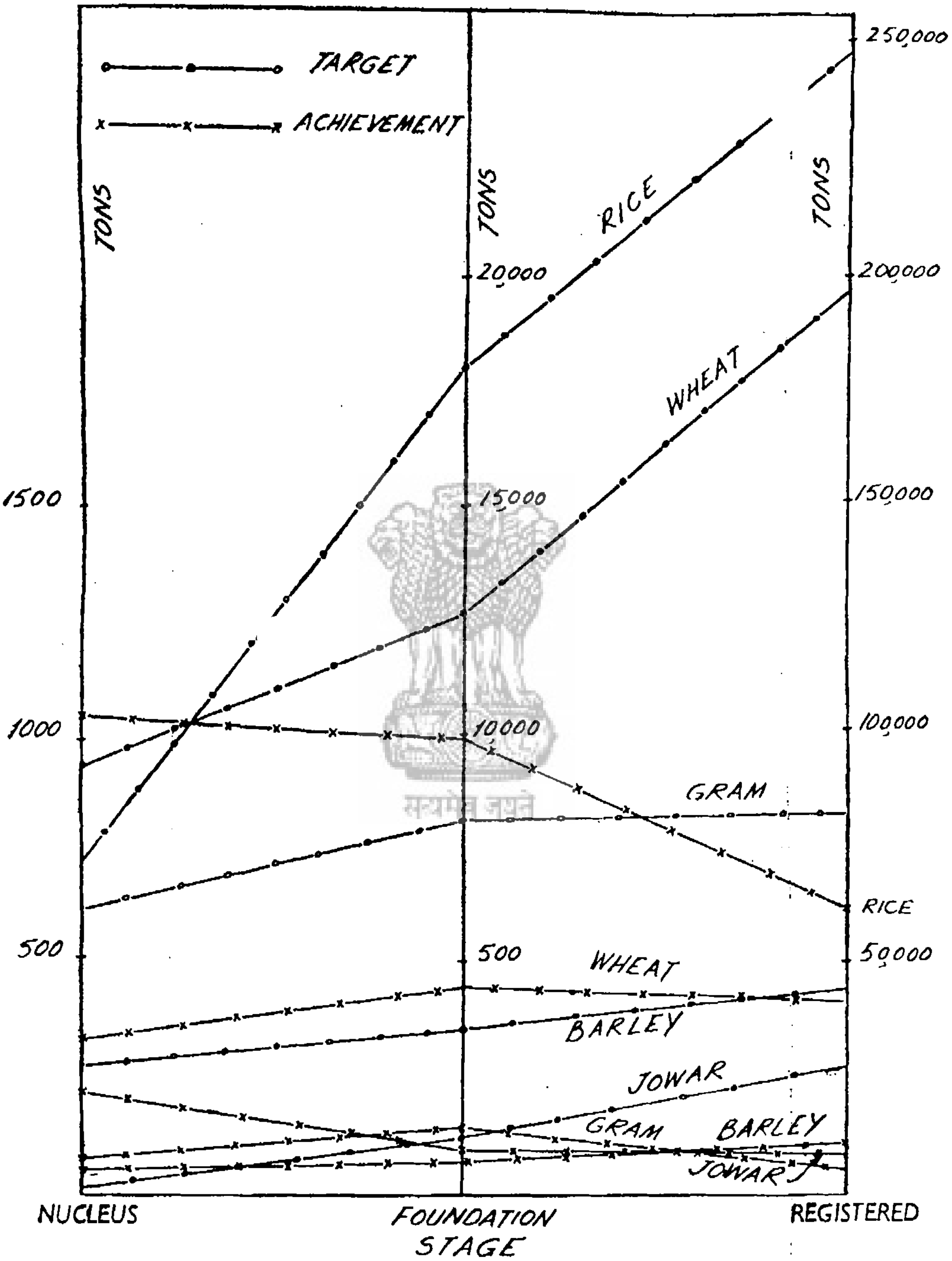


Fig. 1 *TARGETS AND ACHIEVEMENTS IN IMPROVED SEED DISTRIBUTION IN INDIA FOR FOOD CROPS DURING 1959-60. FLOW SHEET FROM NUCLEUS TO REGISTERED SEED STAGES*

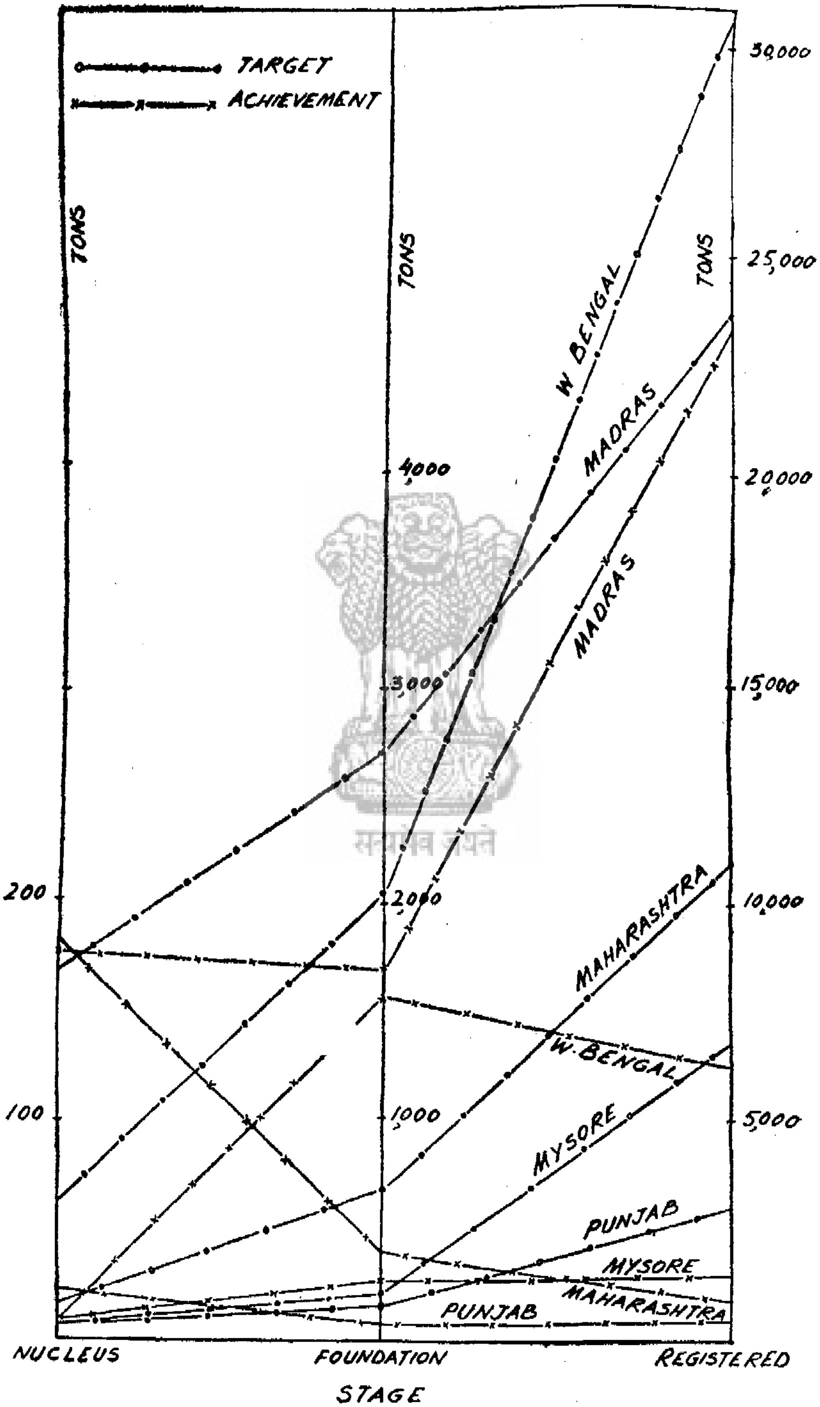


Fig. 2 *TARGETS AND ACHIEVEMENTS IN IMPROVED SEED DISTRIBUTION OF PADDY IN DIFFERENT STATES (TON) 1959-60*

The above data from different States relate to about 75 per cent of the rice area in India, 90 per cent of gram, *bajra* and wheat, 50 per cent of maize and practically the entire area under cotton and barley, and may therefore be considered fairly indicative of the progress of seed multiplication in India. The achievement in the different stages for different crops is discussed below :

(1) *Rice* : In India as a whole, the production of Nucleus seed of rice is more than adequate for the requirements of State Seed Farms for saturation of the total cropped area once in five years (Fig. 1). The only exceptions are Madhya Pradesh and West Bengal (Fig. 2). In the former State due to low yields and high seed rates, it is necessary to have two classes 'A' and 'B' of Registered Growers, and in the latter the reason is want of adequate area in the Research stations, and this should be remedied by increasing the area available to the breeders. In the case of Foundation seed, the achievement is 55 per cent of targets in rice (Fig. 1). Many of the State Seed Farms went into production only from 1957-58 and some are still either being established or being brought under cultivation or reclaimed. The Team recommends that the full area necessary for producing Foundation seed should be brought under production by 1961-62. The State Seed Farms should also adopt intensive cultivation using irrigation and fertilizers to get maximum yields. In the case of Registered seed the position is not at all satisfactory, as an average only of 24 per cent of target has been accomplished (Fig.1). More effective steps have to be taken to correct this position.

(2) *Jowar* : The Nucleus seed production of *jowar* is adequate for India as a whole (Fig. 1) but there are some States, such as Madhya Pradesh (Fig. 3) ,where better varieties should be evolved and more nucleus seed has to be produced which is not difficult in this crop with a high multiplying rate. Even in the production of Foundation seed, about 90 per cent of target has been covered in India as a whole (Fig. 1) and it is quite easy to raise it further provided suitable varieties are available. The position of Registered Seed in *jowar* is however unsatisfactory as only 12 per cent of target has been reached (Fig. 1). Distribution arrangements have to be intensified as the seed can be produced in adequate quantities.

(3) *Bajra* : Although about 70 per cent of the target has been achieved for the Nucleus seed of *bajra*, there is a lack of suitable varieties in many States. The distribution of both Foundation and Registered seed of *bajra* is negligible, being only 5 per cent and 9 per cent respectively. Hybrid seed offers an effective method of increasing production but the technique is difficult and a large amount of land is required to produce this. Till such time as the hybrid programme makes tangible progress, the Team recommends that the

As already mentioned there should be a main Research station in Rajasthan the largest *bajra* growing State and an effective programme of producing hybrid seed initiated.

(4) *Wheat* : Unlike the crops with a higher multiplying rate such as rice, *bajra* and *jowar*, even the production of Nucleus seed is insufficient in wheat in all the States (Fig. 4). The All-India achievement against saturation is 34 per cent in the Nucleus and the Foundation stages and only 19 per cent in the Registered stage (Fig. 1). In some States like Madhya Pradesh the Registered seed includes also bulk purchases besides what is grown by Registered Growers and in Rajasthan a fair supply is got from the mechanised farm at Suratgarh the seed of which is however reported to be of poor quality by Growers. In areas where the crop is grown largely under irrigation as in the Punjab, it is possible to raise adequate Nucleus and Foundation seed for saturation from the irrigated crops. Where the crop is mostly rainfed, as in Maharashtra, one more class 'B' of Registered Growers will be necessary. This is contemplated in this and other States, while it is already in vogue in Madhya Pradesh. As in other crops, the distribution of seed is inadequate for saturation.

(5) *Maize* : The quantity of hybrid maize seed distributed in India is small. In the Punjab about 5,000 maunds and at Tarai 4,000 maunds of hybrid maize seeds were produced in 1959. These double-cross maize seeds are dent types and are not popular with the Growers. The preference is for yellow flint type. Flintish hybrids suitable to different States have since become available. For example V.L. 54 evolved in Vivekananda Laboratory, Almora has been found to be the best yielder in Almora, Tarai, Meerut and Kalimpong. Another hybrid V.L. 45A has proved as good as the best dent hybrids in Delhi, Ajmer, Naraingarh and several other centres. Also four high yielding, flint type hybrids of maize possessing suitable maturity periods have been recently produced under the All-India co-ordinated Hybrid Maize Scheme sponsored by the Indian Council of Agricultural Research with the active co-operation of the Rockfeller Foundation. These hybrids are equal to the best dent-type American maize hybrids tested in India. The four hybrids are such that they can cover the entire maize area in the plains of India. Some of the hybrids under test would suit the northern hills of India also, although the American dent-type hybrid U.S. 13 is suitable for production in the northern hills. The Ministry of Agriculture has also in hand a scheme for the creation of an autonomous All India Seed Corporation for co-ordinating the work of production and distribution of other flintish hybrid maize seed. According to their estimate the operating cost of production of a maund of hybrid maize seeds would be Rs. 40.81. On the other hand, hybrid maize seeds produced in decentralised small unit as is being done at the Vivekananda Laboratory, Almora for the past 11 years can cost only Rs. 25 per maund with a reasonable margin of profit. Since cost of hybrid seed distributed to the farmers is an important consideration, the Team considers that leading maize

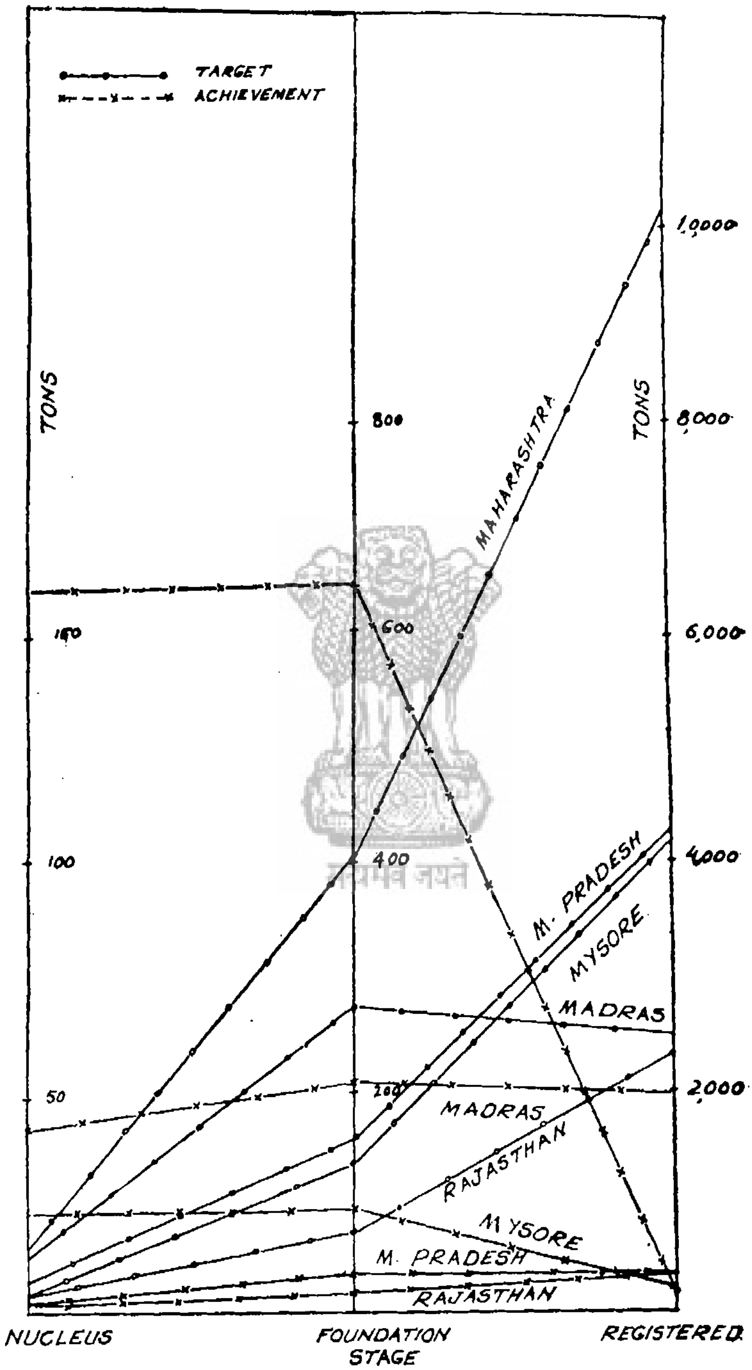
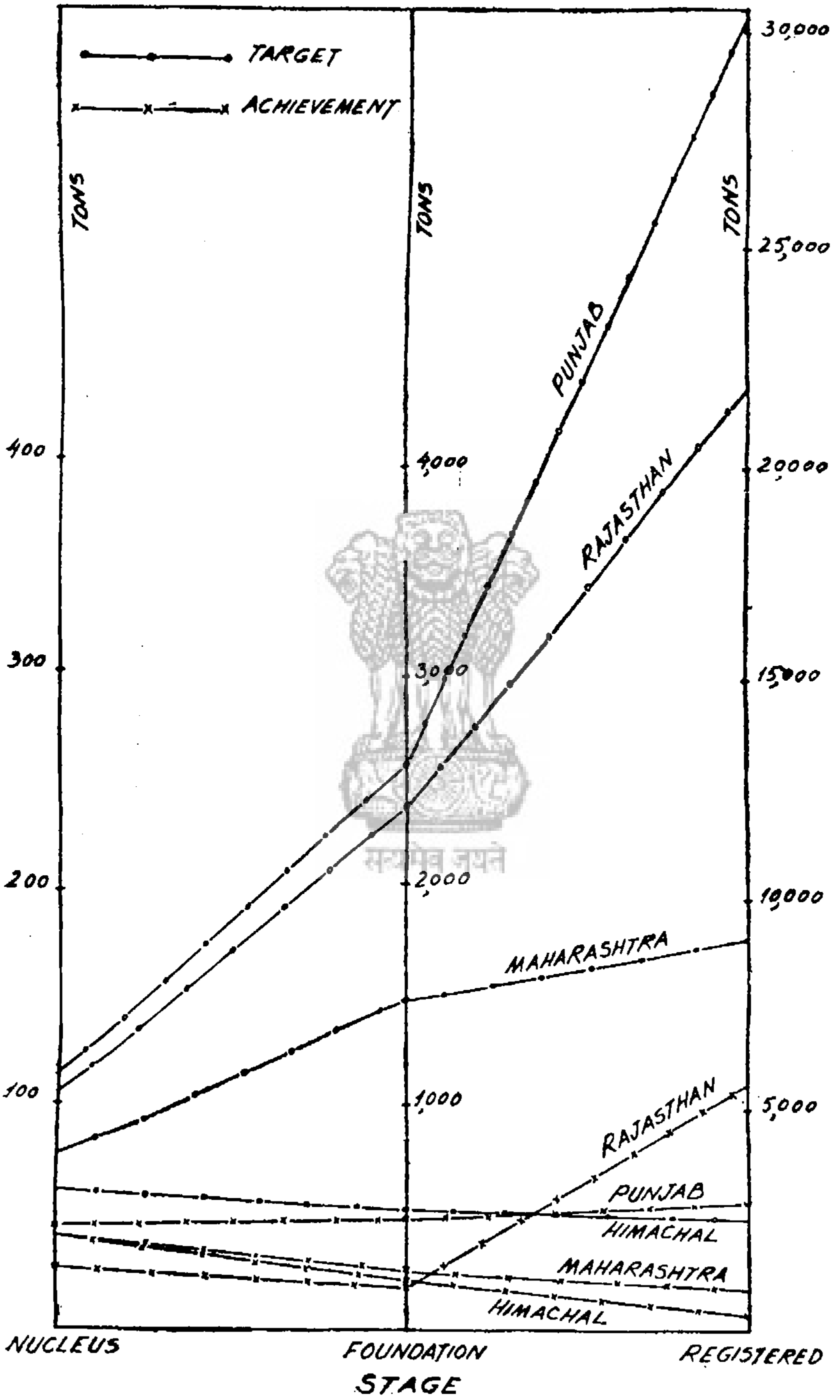


Fig. 3. *TARGETS AND ACHIEVEMENTS IN IMPROVED SEED DISTRIBUTION OF JOWAR IN SELECTED STATES IN 1959—60 (TONS)*



4. TARGETS AND ACHIEVEMENTS IN IMPROVED SEED DISTRIBUTION OF WHEAT IN SELECTED STATES (TONS)1959—60 FLOW SHEET FROM NUCLEUS TO REGISTERED STAGE experts should meet and examine the various methods including the one evolved at Almora and find out how the cost of hybrid maize seed could be lowered.

(6) *Barley* : Improved varieties of barley are multiplied in four States of Uttar Pradesh, Punjab, Bihar and Rajasthan but only in Uttar Pradesh distribution of seed is done on a comparatively large scale. For the whole of India, the quantity actually utilized represents only 14 per cent of the requirement at Nucleus and Foundation seed stages and 11 per cent of that at the Registered seed stage (Fig. 1) The seed programme has to be strengthened appreciably to obtain better coverage in the Third Plan period.

(7) *Ragi* : The production of Nucleus seed is more than adequate for *ragi* but there is a sharp fall in the two subsequent stages, the quantity handled being 30 per cent and 3 per cent in the Foundation seed and Registered seed stages respectively. With adequate improved varieties available in all States and with a very high multiplication rate, there should not be any difficulty in producing enough Foundation and Registered seed. The current stock of *ragi* seeds of the Registered Growers in Mysore was not taken by farmers. Since the seed rate is very low the *ryot* requires only small quantities for sowing and when once he takes the supply he seldom renews the stock. A good deal remains to be done in the distribution arrangements in this crop, if the cycle of saturation has to be attained.

(8) *Gram* : In gram, the quantities distributed in all the three stages is very low, being 12 per cent, 14 per cent and 8 per cent of the requirements in Nucleus, Foundation and Registered stages respectively (*vide* Table IV). Except in the Punjab, the coverage is very poor elsewhere. The main difficulties against a large coverage are the high seed rate and low multiplying factor. This is an important food grain in many States and with such a low coverage the contribution to production by the use of improved varieties must be almost nil. The Maharashtra State is proposing to have special seed farms for gram and wheat and also an additional stage of multiplication by Registered Growers *i.e.,* two stages 'A' and 'B'. The crop is irrigated to a limited extent in Uttar Pradesh, Punjab and Rajasthan and perhaps under such condition the production of Foundation seed can be maximised to ensure adequate supply to Registered Growers.

(9) *Other Pulses* : Data on the distribution of pulses in the different stages are not available in most States. Improved varieties of *tur* are distributed on a noticeable scale in Uttar Pradesh, Gujrat, Mysore and Andhra. Distribution of improved varieties of *mung, urad* and horse-gram exists only on a very small scale in many States. In Uttar Pradesh 50 tons of Nucleus seed, 1,074 tons of Foundation seed and 7,070 tons of Registered seed were distributed for all pulses put together, while in other States the quantities distributed were small and negligible. The Team considers that considerable attention

should be devoted to seed programmes of pulses in the Third Five Year Plan.

(10) *Minor Oilseeds* : In this group which includes *til,* castor, niger and safflower, the seed rate is low and the multiplication rate is very high. It is therefore possible to dispense with the last stage of multiplication and produce enough seed in State Seed Farms for direct distribution to Growers. These crops can be grown as border crops or in mixtures and this is an advantage. The distribution of improved varieties of these crops also varies according to the preference which each State has for the particular crops. The Team therefore recommends that in the case of these minor oilseed crops a large quantum of distribution of improved seeds may be made directly from the State Seed Farms supplemented, to the extent necessary, by Registered Growers' seed especially for fresh releases of strains.

(11) *Minor Cereals* : This group of crops has not received much attention except in one or two States and quantities of seed distributed are negligible. These crops are largely grown rainfed in precarious tracts and by the poorer farmers and the Team therefore recommends that some attention should be devoted to these crops. To begin with even massed bulk selections could be of some value until regular improved varieties become available.

(12) *Cotton* : Cotton is the only crop where seed distribution arrangement can be considered most satisfactory. Against a target of 26,299 tons required to saturate the area once in five years, 28,000 tons were actually distributed during 1959-60 in the main cotton growing States. The success here is mainly due to the special schemes jointly financed by the Indian Central Cotton Committee and the State Governments since a long time. Legislation, trade interests due to the large industry, premium obtainable for pure cotton and intensive regional research have all contributed to the success of seed schemes in cotton. The multiplying stages in cotton vary in different States and usually are from five to six. An examination of the cotton schemes in Maharashtra, Madras, Mysore and Andhra Pradesh showed that the multiplication programme is followed systematically through all the stages with sufficient safeguards for purity. The Team however noted that, while the coverage by improved varieties of irrigated cotton was as high as 80 to 90 per cent in different States, it was only about 50 per cent in the case of rainfed cotton. The Team therefore recommends that the seed schemes of rainfed areas should receive greater attention.

(13) *Sugarcane* : The coverage by improved varieties of sugarcane in India is the largest for any crop, being about 90 per cent. The Team recommends that steps should however be taken to see that disease free setts - are supplied periodically to farmers from special short crop, so that the varieties can be maintained almost disease free. Some work in this direction is being done in some

States and the sugar factories are also actively encouraging the production and supply of disease free seed material.

Effectiveness of distribution arrangements at different stages.

3.5. From what has been said in the earlier paragraphs the supply position of seeds can be summarized as follows :—

(a) *Nucleus seed* : The supply position of improved seed from the Nucleus stage is more or less adequate for rice, irrigated wheat, *jowar, bajra, ragi* and cotton. Nucleus seed is inadequate for *barani* wheat, gram, barley, groundnut, pulses, small millets and other oilseeds.

(b) *Foundation seed* : The supply of Foundation seed is adequate for cotton and is 90 per cent of requirements for *jowar*. With regard to other crops it is only 55 per cent for rice, 30 per cent for *ragi*, 12 to 14 per cent for gram and barley and less than 5 per cent of the requirements for other crops namely *bajra*, maize, groundnut, minor cereals, pulses and other oilseeds.

(c) *Registered seed* : The distribution of seed at the Registered stage is inadequate for all crops, except cotton. It forms only 24 per cent of the requirements for rice, 19 per cent for wheat, 12 per cent for *jowar*, 11 per cent for *ragi*, 9 per cent for *bajra*, 7 per cent for gram and less than 3 per cent for other crops.

The large deficiency at the Registered seed stage when farmers are actually to use the seed must be considered as serious. It is hoped that with the establishment of all the State Seed Farms programmed and bringing them all into effective production level the deficiency in the production of Foundation seed could be overcome. Further more, the production of seed in the first two stages is under the direct control of the technical departments of the State. The deficiency in the last stage can be made up only with a proper organisation of non-official agencies, the Government departments giving the necessary technical help. An effective organisation has to be built up taking the villages as units. This is the opportunity for the newly formed villages to make an effective contribution for the improvement of agriculture, right at the stage where it can have the maximum benefit. Seed schemes may not have received the attention they deserved in the past but schemes of some kind or other have been running for the last 40 years in some of the crops of major importance such as rice, wheat, *jowar* etc., and the fact that still the coverage is not more than 50 per cent calls for serious thinking and effective remedies. How this position can be changed is discussed in the later chapters.

CHAPTER IV

COMPARATIVE ECONOMICS OF VARIOUS TYPES OF SEED SCHEMES IN INDIA

The General Scheme of seed multiplication and distribution in the First Five Year Plan.

4.1. Under the Grow More Food campaign in the First Five Year Plan, schemes for seed multiplication and distribution were in operation in all the States of India for food grains and the States got help from the Centre in the form of loans and grants. Some States had also separate schemes of their own for paddy, *jowar,* wheat, etc. During the year 1953-54, the Centre provided 73.94 lakh of rupees as loan and 41.2 lakh of rupees as grants to run 42 seed schemes in 23 States of the country. In these schemes each State drew up its plan according to its resources, keeping in view the targets fixed by the Government of India for increased production. The main advantage of these schemes was that a machinery was set up for distributing a large quantity of improved seed of food grains and the experience gained helped in co-ordinating later work. The schemes involved considerable State trading on the part of the technical staff of the Agricultural Department. The Government of India contributed part of the premia paid for the procurement of improved seed, which became a normal feature. Usually there were two stages of procurement; one for primary seed from 'A' class Registered Growers, who got the seed direct from Research stations and another from 'B' class Registered Growers for distribution of secondary seed to the general cultivators. Some States had a 'C' class and occasionally also a 'D' class of Registered Growers. A large volume of improved seed was distributed during the First Plan period, but the planning of seed production was on an *ad hoc* basis in many States. It must be said however that though there was considerable volume of seed distribution there was practically no control on the quality of seed distributed.

4.2. *The State Seed Farm Scheme* : This scheme was introduced by the Ministry of Agriculture in all States from the year 1956-57, based on the recommendations of the Standing Expert Committee on Seeds. The object was to make each C.D. Block self-sufficient for its requirement of improved seed by providing it with a Seed Farm for multiplication of improved breeder's seed received from the Research Stations. One seed store was to be provided for each seed farm, besides storage godowns in the Blocks. The Government of India provided financial assistance on the basis of 75 per cent subsidy and 25 per cent loan for the value of the land to be acquired up to Rs. 1,500 per acre and Rs. 10,000 for the construction of a store in each farm besides loan for providing irrigation facilities.

The main advantages of this scheme were :

- (a) the primary seed, now called Foundation seed was produced directly by the State Agricultural Department in their own Seed Farm;
- (b) the quality of the seed could be directly controlled by the Agricultural Staff;
- (c) the production and distribution of seed of improved quality was localised to make each Block or unit self-sufficient; and
- (d) the overall seed programme of the State was planned to saturate the whole of the area under important crops once in a specified period, usually five years.

In the first few years of the scheme, most of the States confined their attention to only cereals, but later on other crops like groundnut and pulses, were also taken up. In the Third Five Year Plan, seed schemes will include all important crops.

(1) *The sufficiency of the State Seed Farm Scheme in India* : The establishment of State Seed Farm was based on a provision of one farm of 25 acres under self-fertilised crops for every C.D. Block, which meant 5,164 units of 25 acres or 1,29,100 acres to serve a cropped area of 2,500 lakh acres. It must, however, be mentioned that much large area than 25 acres was needed for maize which is a cross-pollinated crop. By the year 1959-60, 3,244 seed farms were established against a target of 4,000 for the Second Five Year Plan (c.f. Table V).

TABLE V

Number of State Seed Farms in the States of India in 1959-60 *in units of 25 acres*

State	No. in units of 25 acres
Andhra Pradesh	428
Assam	144
Bihar	441
Maharashtra	202
Gujrat	371
Madhya Pradesh	192
Madras	132
Orissa	68
Punjab	176
Uttar Pradesh	677
West Bengal	99
Jammu/Kashmir	55
Mysore	51
Rajasthan	164
Kerala	16
Himachal Pradesh	12
Tripura	8
Andamans	1
Pondicherry	1
N.E.F.A.	6
TOTAL	3,244

It will be seen from *Appendix VI* that the area required to saturate the area of important crops once in five years would be 1,20,635 acres or 4,824 units, exclusive of cotton. The original target of 5,000 units proposed by the Ministry of Agriculture can therefore be considered adequate.

The targeted area under seed farms for different crops and the total cropped area during 1959-60 are given for eight States in *Appendix V*. During that year, the progress of cultivation in the State Seed Farms had attained 72 per cent of the target in rice, 50 per cent in wheat, 29 per cent in *bajra,* 73 per cent in *jowar,* 64 per cent in *ragi* and 40 per cent in maize. It was 35 per cent in potatoes and 33 per cent in jute. The cropped seed farm area in gram and groundnut was only 4 and 7 per cent respectively. The non-attainment of the target was due to (i) there was some delay in the establishment of seed farms in some States and (ii) work was confined to major cereals to begin with. It is therefore necessary that steps should be taken to attain the target for seed farms and bring the farms to a high level of production by carrying out all necessary improvements and achieving full cultivation in the farms.

(2) *Sufficiency of State Seed Farms area*: The information in *Appendix VI* is only indicative since the land in many of these seed farms are still being reclaimed and brought into production. The targets have been worked out on the assumption of having only one Registered Stage for all crops, except cotton and groundnut. In Madhya Pradesh and Uttar Pradesh, the targets are based on the existing or proposed two stages of Registered Growers. In all the States, the proposed area in the Second Five Year Plan if fully cropped is generally adequate for rice, *jowar* and *bajra* but not for wheat in the two States of Mysore and Himachal Pradesh. If gram is included, more area will be required in the Punjab and West Bengal. If groundnut is also included even with two classes of Registered Growers, more land will be required, particularly in Mysore, Madras and West Bengal.

Taking into consideration the effect of improvements in cropping and irrigation facilities, the additional area that will be required for the Third Five Year Plan is given in Table VI.

TABLE VI

Additional area likely to be required for saturating the area once over five years in the Second Five Year Plan allotment (acres)

State	Existing IInd Plan Target	Additional area required in the IIIrd Plan			
		Wheat	Gram	Groundnut	Total
Himachal Pradesh	720	150	—	—	150
Madhya Pradesh	16,000	—	—	—	—
Madras	5,200	—	—	2,000	2,000
Mysore	1,600	1,500	1,000	1,000	3,500
Rajasthan	5,700	—	—	—	—
West Bengal	2,500	—	—	500	500
Maharashtra	13,000	—	1,000	—	1,000
Punjab	5,700	—	4,000	—	4,000
TOTAL		1,650	6,000	3,500	11,150

Before considering establishment of new seed farms for the Third Five Year Plan, the Team considers that steps should be taken to see that the existing farms, comprising 1,00,000 acres are fully cropped. The Team noticed that in some States, as in the Punjab and Mysore, the Registered seed now produced is not fully utilised for sowing. The Team, therefore recommends that proposals for new seed farms should be considered only after making sure that the existing seed farm area including area under the Agricultural Farms or large seed farms in a number of States that were being utilised for demonstration and seed multiplication prior to the initiation of the Seed Farm Scheme is fully and efficiently utilised and full use is also made of the Registered seed already produced by improving upon its distribution.

(3) *Size of the State Seed Farm Units*: The original proposal of the Ministry of Agriculture to have a seed farm of 25 acres for each C.D. Block is being followed in some States, as in the Punjab and West Bengal. Due to certain difficulties, States like Rajasthan and Madhya Pradesh, began work with larger farms of 100 acres. In some States as in Maharashtra and West Bengal where the establishment of C.D. Blocks had not progressed sufficiently, seed farms were set up on the basis of revenue *talukas.*

Experience showed that the establishment charges on account of Farm Manager and subordinate staff amounted to Rs. 3,500 to 4,500 per farm or roughly Rs. 150 per acre. Studies were made by the Team to determine the relation of establishment and cultivation charges to the size of the farm and the data, although scanty in some cases but indicative, are presented in table VII below :

TABLE VII

Cost of cultivation and establishment charges per acre according to the size of Farms

Cost of production per acre			Establishment charges per acre		
Size group acres	Maharashtra (Rs.)	Madras (Rs.)	Size group acres	Madras (Rs.)	Mysore (Rs.)
Below 25	160·0	353·0	21-30	115·6	147
26-35	111·2		31-40	107·3	
36-45	91·4	286·0	41-50	99·0	
46-55	88·0	266·5	51 & above	67·5	76
56-65	72·0	351·4			
Above 65	66·4				

From the data, the Team considers that the economic size for the seed farms would be at least 50 acres for irrigated lands and about 100 acres or more for unirrigated lands. In Madras, Maharashtra and Mysore, the size of the farms is now 50 acres or more and the earlier established smaller farms are being enlarged. The large farms of 100 acres or more in the case of rainfed crops is an advantage since the multiplying rate is low for these crops.

The Team, therefore, recommends that the farms proposed to be established in the Third Five Year Plan should be of the minimum size of 50 acres each and that the existing small farms may be enlarged suitably.

(4) *The practice of leasing*: The Team found that the taking lands on lease for establishing of seed farms resulted in losses, both in Mysore and Madras. The Team is strongly of the opinion that the practice of taking lands on lease for State Farms should be stopped. In the Punjab, a different procedure is adopted by leasing out the State Seed Farms to one or more tenants. Generally this was profitable to the tenants who gave only a third of the produce to Government. From what the Team found and heard during its visit to Punjab it feels that this practice is not conducive to the maintenance of purity although a case has been made out by the Government to give this system a fair trial.

(5) *Income and expenditure of State Seed Farms*: *Appendix VII* provides information on the income and expenditure of the State Seed Farms in Madras, Mysore, Maharashtra, Madhya Pradesh, West Bengal and Rajasthan. In Madras, Mysore and Maharashtra, the State Seed Farms in general have been able to meet the cultivation expenses. There was a small profit in Mysore and Maharashtra and a fair profit of Rs. 102 per acre in Madras. If, however, the establishment charges are also taken into consideration, all the farms except those in Madras are working at loss. Even in Madras, the profit in 1959-60 could not meet the interest on capital. During 1959-60, the loss per acre allowing for all recurring expenses, including establishment charges, was Rs. 260 in Madhya Pradesh, Rs. 171 in West Bengal, Rs. 131 in Rajasthan and Rs. 127 in Mysore. In Madras there was a profit of Rs. 21 per acre.

There are also wide variations in the profit and loss position of individual farms (*Appendix VII*). In Madras it ranged from –Rs. 21,900 to + Rs. 43,000, in Madhya Pradesh from + Rs. 1,200 to Rs. –45,000. Many of the losing farms are being reclaimed and improvements effected to increase yields per acre. Some of the large profits in some Madras, Mysore and Maharashtra farms are due to growing highly paying crops like potato and sugarcane. Further, establishment charges have been reduced as a result of the increase in size and some economy effected in the staff. In the Punjab, the occurrence of losses has been met by leasing the lands to tenants. In Madhya Pradesh and Rajasthan the Team finds that there is great scope to reduce losses by intensifying cultivation and stepping up acre yields. Maximising acre yields by all possible means must be a desirable step practically in all seed farms in the country. Where irrigation facilities exist multiple cropping must also be introduced. The aim should be to increase production by at least 20 per cent in the Third Five Year Plan.

The Team also considers that more profits can be made if the areas of the farms are fully cropped. The comparatively better economic position in Madras farms is due to high cropping efficiency with multiple cropping.

Comparison of different systems of distribution of improved seed.

4.3. The method employed for distribution of imported seeds in different States may be classified as follow :

(a) *Procurement and distribution by the Department* : Madhya Pradesh, Himachal Pradesh, Punjab, Uttar Pradesh, Rajasthan, Andhra Pradesh, Assam and Kerala.

(b) *Procurement and distribution by Co-operative Societies* : Maharashtra and Gujarat.

(c) *No procurement but distribution by Registered Growers by exchange or cash* : West Bengal, Mysore and Madras (in part).

(d) *No procurement but distribution by Registered Growers with a premium under the direction of Panchayats in association with Co-operative Societies* : Orissa, Rajasthan and Madras (proposed) (in part).

(1) *Procurement by the Agricultural Department and State Trading* : The Agricultural Departments were procuring improved seed from 'A' class Growers by payment of a premium in all States in the First Plan period. In some States there were more than one stage, 'A' to 'B' and even 'B' to 'C'. The seed procured in the final stage is given to the general cultivators. The system involved payment of premia on a large scale during each stage of procurement and also considerable State Trading by the technical staff. This put a great strain on the concerned officers, not only in handling stocks and rendering accounts, but also in finding explanations for losses when they occur. The quantities of improved seed of food-grains distributed, particularly of paddy and wheat, every year by the Agricultural Departments were comparatively large between 1951 and 1955. The advantages of this method of departmental procurement were that (1) the average *ryot* prefers to buy improved seed rather direct from the Department than from other *ryot;* (2) the improved seed is tested by the Department before procurement and the quality is thus ensured; and (3) the Department could store the seed, while the Registered Growers may sell away the seed as grain. During the year 1959-60 the quantities of improved seeds procured and distributed by the Agricultural Departments in the important States were 29,602 tons of paddy, 37,710 tons of wheat, 5,398 tons of gram, 870 tons of *jowar,* besides smaller quantities of seed in other crops. The above system has been in vogue for over 40 years, but many States have given it up mainly due to difficulties of State trading and handling stocks and they are not likely to take it up again.

(2) *Payment of premia* : When procurement is made, payment of a premium for the seed procured is made, either by the Department or the Co-operative Societies. In Mysore, the payment of premia is

made not on procurement, but on the quantities distributed as verified and certified by the Extension staff. The advantage in this is that the Department does not handle stocks and there is no State trading. In Maharashtra, the Co-operatives procure seeds at a premium of Re. 1 per maund at harvest time and distribute the seed at the same premium at the sowing period. It is expected that as the prices at the sowing time are higher than those at harvest, the Co-operatives can make sufficient profit. This system also avoids State trading, but the quantity of seed distributed is limited. In Gujrat, the premium paid to Registered Growers in only 50 nP. per maund and the seed is sold by the Co-operatives at a premium of Rs. 1.50 per maund over market rates and as such there is a specific margin provided. In the Punjab a payment of premium at the rate of Re. 1 per maund is paid.

The amount of premia paid to Registered Growers by the Departments in different States ranged from Re. 1 to Rs. 2 per maund of food grains or from 10 to 12½ per cent over market rates, but the former is more common. In Uttar Pradesh the seed is procured by the Department and given to the Co-operative Societies for distribution to the members.

(3) *Subsidies* : In addition to the premium on improved seeds, certain States used to pay subsidies to the Registered Growers for the services rendered. In Madras, a subsidy of 12 nP. per bag of two maunds for sealing the bags and 25 nP. per bag towards incidental charges were paid. In Madhya Pradesh, the subsidy and premia varied in different regions and with the crops and both are paid in certain regions of this State as Rs. 2 per maund premia and Re. 1 per maund subsidy for wheat. In Bihar the subsidy is Re. 1 per maund. In Mysore the Department pays a bonus of Rs. 5 per acre irrespective of seed distributed. In Andhra Pradesh a subsidy of Rs. 2 per acre for rogueing in millets and up to Rs. 4 per acre for rogueing in rice, is given.

The Team was informed by the Registered Growers in the Punjab and Rajasthan that the premium they were getting was not adequate. In Uttar Pradesh the premium is proposed to be raised from 12½ to 20 per cent of the market rate. The Team is of the opinion that the premium should be decided by the States concerned on the merits of each case in each region. In some States as in Mysore, the premia were not fully availed of by the Registered Growers. In Madras, the subsidy fixed was never availed of by the Registered Growers.

The Team considers that the mere enhencement of the premium is not likely to increase the seed distributed as the more important factors are the quality of the seed and the effectiveness of distribution arrangements. There are States where no premium is paid to Registered Growers, but still a large quantity of improved seed is sold on cash or on an exchange basis. The Team considers that if the system of distribution through Registered Growers to other growers is localised to each village, there will be no necessity for payment of fixed premia by the Government. In this case any extra price to be paid for improved seed may be fixed suitably for each village by the *Panchayats* in consultation with the Growers concerned.

(4) *Loans for seed and exchange in kind*: The Agricultural Departments of the States give loans to the farmer for buying seed as in the case of other loans. In some States the loan advanced for seed is recovered in kind with some addition as in the *batai* or *sawai* or *Bari* system. The main difficulty in this system is that it is not possible to ensure the quality of the seed obtained and the Department will have to handle large stocks of seed, some of which may have to be sold in the open market as being unsuitable for seed purposes. This introduces again State trading. In Orissa, the quantity of seed issued as a loan is recoverable with 25 per cent extra and the loanee also undertakes to sell to the Department 10 times the quantity borrowed at a premium of 12 per cent over the market price. The seed collected by the *Gram Panchayats* are again distributed to other growers. In Assam, paddy seed is issued for cash payment, but the *Sawai* system is adopted in the case of Jute. The Team considers that from the point of view of quality of seed the system of exchange in kind by the Agricultural Departments is not desirable and that if loans are to be given they may be in the form of *taccavi*, or through Co-operative Societies.

Distribution of improved seed by the Co-operatives.

4.4. The distribution of improved seed through Co-operatives is practised in some States, as in Orissa, Gujrat and recently in Maharashtra. The main advantage in this is that it encourages self-help and co-operation among the *ryots* and relieves the Agricultural Departments from State trading. It is not possible to get full information on the quantities actually distributed by the Co-operative Societies, but it is estimated that it amounted to 50 per cent of the Registered seed produced in Gujrat and five times the Foundation seed distributed to Registered Growers in Orissa.

The main difficulty in the distribution of improved seed by Co-operative Societies is that it does not provide them a running business. Improved seed has to be purchased at harvest time and stocked till sowing time and between these periods there will be no sales. In addition, the Co-operative Societies have other more paying business activities as sale of fertilisers, iron, steel and implements. Some Societies are not willing to take up sale of improved seeds on a large scale for fear of losses. There are also routine procedural delays as in the fixation of prices and filling up of loan forms. The Team, therefore, considers that the distribution by Co-operative Societies of improved seed can be encouraged only where the work has proved satisfactory. They can be used to supplement large scale distribution through more general agencies like the *Panchayats* in each village and for advancing loans for seed to the poorer classes of agriculturists.

Village Seed Farms and seed distribution.

4.5. The system of distributing seed for each village by Registered Growers was introduced in Madras in the year 1953-54 in order to make each village self-sufficient for its requirements and also to reduce the handling of large stocks of seed by the Agricultural Department. This is popularly known as Village Seed Farms. A similar system is now being introduced in West Bengal, by having a Registered Grower for every village. Even in States where other systems are in force, the system of sale by Registered Growers to others for cash or by exchange exists as in Mysore. In fact, when there is no procurement, this is only the method that can be followed. Of all systems of seed distribution, this method offers the best scope for large scale distribution. The advantage is that it can be combined with any other system, whether worked by the Agricultural Department, Co-operative Societies or *Panchayats.* To maintain the quality of seed, this system has to be supplemented by an effective supervision of the transactions as in Madras. The practice in Madras of testing all Registered seed and sealing the bags of such seeds as are satisfactory is a good precaution in the working of village Seed Farms. Even when *Panchayats* take up the work, the system of sale from Registered Growers to other *ryots* can continue as a normal practice, while procurement can be undertaken to the extent necessary, particularly to benefit the poor classes of agriculturist, who may not be able to pay cash. The most important advantage of this system is that it eliminates large scale handling of seed by Co-operatives or the Department.

In working this scheme, the Team considers it necessary that every Registered Grower should keep a record of his transactions, mentioning the quantities, varieties and names of *ryots* to whom the seeds are sold or given in exchange. Officers of the Agricultural Department and distinguished persons may be invited where feasible to be present when such distribution takes place so that the value of improved seed is generally made known. The quantity of seeds distributed through village Seed Farms during 1959-60, in Madras, was of the order of 24,000 tons of paddy seed and 2,000 tons of millets.

Distribution of improved seed by Village Panchayats.

4.6. The entrustment of developmental work to the democratic control of *Panchayats* has taken place in Rajasthan, Andhra Pradesh and Madras. In all these States, distribution of improved seed has been included as one of the items of work for the *Panchayats.* This system has a distinct advantage, as it provides for a seed distribution unit in each village. The general set-up as obtaining in one State is as follows : The Presidents of the Village *Panchayats* are members of the Block *Samiti,* and the Presidents from each of these *Samitis* form the *Zila Parishad* for the district. The Block Development Officers become Secretaries to the *Samitis* and the Collector a member of the *Parishads.* The staff in the Blocks will work under the control of the *Samitis* and Government will pay the salaries. The technical programme for each Block is drawn up by the Agricultural Officers and the provision of funds is also made through the Agricultural Department. The recommended varieties are approved by the *Panchayat* organisation for each Block and by the *Gram Panchayat* for each village. The Registered Grower in each village has to grow only the varieties approved by the *Panchayat.*

A further improvement in this scheme has been made in Madras, by designating the Registered Grower as a *'Gramsahayak'* of the village. His function is to multiply and distribute improved seed and also demonstrate in his field improved agricultural practices. The selection of *'Gramsahayaks'* can be made from the trainees in the 'Village Camps' organised by the Government. It is reported that about 25 lakh persons have been so trained in India, although the period of training has been short. These *'Gramsahayaks'* will not be paid employees either of the Government or of the *Panchayat,* but can receive a premium of Rs. 2 per maund of improved seed distributed under the control of the *Panchayats.*

In the execution of the scheme in Madras, improved seed is given for cash to the *Panchayat* organisation, or to the Co-operatives, if they come forward. The improved varieties to be grown in each village are listed by the Extension Officer, approved by the *Panchayat* and finally approved by the District Agricultural Officer who should satisfy himself that the quantities of seed asked are not in excess of requirements and can be supplied. Every Village *Panchayat* draws a seed multiplication programme for the village, mentioning the quantities of each variety required. The *Panchayats* may choose more than one *'Gramsahayak'* for each village, and enter into an agreement with them in a form of contract similar to that now used by the Department. Improved seed is defined as "seed certified as such by an officer of the National Extension Scheme Establishment and includes the progeny of such seed of the first and second generation only". The premium on seed is fixed at Rs. 2 per maund of paddy and millets distributed. The services of the staff of the Community Development Blocks are provided to the *Panchayats* free of charge.

The financial requirements for implementing these schemes will be made available to the *Panchayats* in the form of Agricultural Grants for which there is a provision of Rs. 2 lakhs for 5 years for each Developmental Block. The premium of Rs. 2 per maund for seed distributed is to be met from this provision, subject to a ceiling of 30 nP per standard acre of paddy and 15 nP per standard acre of millet cultivated in the Block.

In Orissa, the system of *Panchayats,* and Co-operative Societies has been operating for some time. Here also the Department does not deal with the Registered Growers, but the *Gram Panchayats.* Agreements in standard forms are taken by the *Grăm Gola* Society in the *Gram Panchayat* on its behalf. A distinctive feature in Orissa is that the Registered Growers are entitled for certain privileges such as purchases of improved seed, fertilisers, insecticides, fungicides and spraying and dusting implements at subsidised rates. Agricultural loans are given by the Co-operative Department through the *Gram Golas* or Co-operative Societies. The Registered Growers get 12½ per cent more of paddy in exchange for his seed. Although this system of *Panchayats* managing seed work has been taken up in the States only recently, it possesses the essential pre-requisite of supplying improved seeds to every village and is, therefore to be recommended.

Comparison of Seed Farm Scheme with special Schemes for cotton and groundnut.

4.7. Special Schemes for multiplication and distribution of a number of important varieties of cotton jointly financed by I.C.C.C. and States have been in operation for several years in the States of India. A large quantity of seed has been distributed in these schemes amounting to about 28,000 tons in 1959-60. The Co-operative Societies are associated with the schemes in the distribution stage. These schemes have special technical staff provided to help in rogueing the crop and supervising the ginning. The total expenditure on these schemes ranged from Rs. 2 to Rs. 3 per maund of seed. The schemes were in operation in every major cotton growing area of the States and examples of varieties dealt with are 320F, 216F and LL54 in the Punjab, Buri 0394 in Vidharba, MCU1 cotton in Coimbatore, MCU2 in Sirivalliputtur and Jayadhar and Lakshmi in the Mysore State. The success in the schemes may be attributed partly to the special staff appointed but mainly to the high premium offered by the trade for pure *Kapas* and lint of these varieties. As such, the improved seeds were in good demand and the trouble taken in maintaining purity is well compensated. The actual operation of the cotton seed schemes is different from Seed Farms as a number of stages of multiplication ranging from 5 to 6 are followed before the cotton seed reaches the farmer.

Special Zonal Nucleus Seed Farms for multiplying groundnut were introduced by the joint financing of the Indian Central Oilseeds Committee and the State Governments. Special staff was appointed to supervise blocks of 30 to 60 acres of leased or Government land, for multiplying Breeder's seed, but the quantities distributed from out of these have been small and are not commensurate with the large requirements in this crop. The Team is of the view that only large areas of State Seed Farms, 100 acres and above, with the introduction of one or more stages for multiplication by Registered Growers can meet the requirements in rainfed areas for groundnut.

For general crops such as cereals, pulses and oilseeds, the system of Seed Farms appears satisfactory as it is easy to operate and fits in with the general pattern of administration of the Agricultural Departments and has the advantage of serving every C.D. Block or *taluka* in a systematic manner.

The package Scheme and distribution of improved Seed.

4.8. In the Package Scheme, the objective is to concentrate attention to selected areas and provide all facilities including equipment and credit for intensifying cultivation so that every cultivator in the area can carry out all of the improvements. These areas have been selected in regions with good water facilities and having a good potential for crop production. The supply of improved seed is one of the steps included in the scheme and as many improved varieties respond well to high-fertility conditions, the scheme has the advantage of an intensive drive towards increased food production on a mass scale. This can also serve to demonstrate the modern methods of scientific agriculture. In some similar schemes, as the Pilot Schemes in Maharashtra State, the emphasis is mostly on manure and not on improved seed. Package deal takes care of distributing improved seed in selected areas and does not dispense with seed programmes in general which have for their objectives the saturation of the whole cropped area in the country by improved varieties within a period of five years.

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CHAPTER V

SUFFICIENCY OF THE IMPROVED SEED PROGRAMME IN RESPECT OF QUALITY

The considerations necessary for the maintenance of the seed quality are (1) the genetic identity of the variety (2) viability of the seed and (3) purity of seed as determined by freedom from seeds of other varieties, externally or internally seed-borne diseases or insect infestation or damage, refractions or foreign matter, and from weed seeds.

Planning of varieties.

5.1. The demand for an improved variety depends on the special characteristics for which it has been evolved, such as high yield, resistance to disease, desired maturity period and suitability to particular regional condition of water supply, temperature and other factors. Although at the State level, the planning of the seed programme is drawn up for different stages in terms of quantities, the plan of individual varieties to villages is drawn up at the district and village level and the supply is made from the Research Stations on indents placed by the District Agricultural Officers. With the information obtained from the pilot survey for the coverage of improved varieties in Madras, a State-wise distribution plan for each variety for each district was drawn up for paddy and supplies provided according to the plan for each variety. In Mysore State also, the distribution of Nucleus seed to the State Seed Farms is directed at the State level by allotting to each district the required varieties from the different crop Research Stations. The Team recommends that in all States, the varietal production of Foundation seed should be taken care of at State level, so that the demand for individual varieties from the cultivators can be effectively met. The Team also recommends that a provision should be made to see that the Registered Grower, in fact, actually grows the variety, the seed of which has been supplied to him.

Preservation of genetic identity.

5.2. Genetic identity can only be ensured by the examination of the growing crop in the field. The Team considers that this should be carried out periodically for every variety in the plant breeding or Research stations. In Most plants, genetical identity is ensured by starting the cycle from self-fed plants every year, as in cotton. In some crops, as in paddy, where the crop is more or less wholly self-fertilised, the precaution of selfing is not taken systematically in many States. The Team however considers that though the practice of starting the cycle with selffed seed every year may be desirable it may be enough to follow it once in 2-3 years. The loss in purity due to natural crossing in successive generations is illustrated in Table VIII below :—

TABLE VIII

Percentage of purity with increase in natural crossing in successive generations

Generations	Percentage of natural crossing						
	1	2	5	10	15	20	30
1st	99·0	98·0	95·0	90·0	85·0	80·0	70·0
2nd	98·5	97·0	92·6	85·4	78·6	72·0	59·5
At the end	98·0	96·1	90·5	81·8	73·9	66·7	53·8

Purity of improved seed.

5.3. The purity of the improved seed is determined only by visual observation by which the presence of other varieties with different grain characters only could be located. It will be possible however to identify off-type plants and remove them in the standing crop either in the State Seed Farms or in the fields of the Registered Growers. In some States as in Madras this work is carried out by the Seed Development Assistants of whom there is one in each Division under the control of Seed Development Officers. In Bengal, seed is tested at the Seed Testing Laboratory in Calcutta. The Team considers that samples of seeds from the State Seed Farms should be checked periodically by the specialist staff who may also inspect the standing crop of Seed Farms to make sure that rogueing has been carried out properly.

(1) *Rogueing* : At the Registered seed stage, the standing crop is usually rogued by the Extension Staff of the C.D. Blocks or in the *talukas* or by the Registered Growers themselves. Some States have a provision in agreement with the Registered Growers that rogueing should be carried out. It is usual to find that the Registered Growers are not willing to remove all off-type plants, as the yield would thereby be reduced. This is a common feature in cotton. The Team also observed that in some States *jowar* and groundnut crops are not rogued at all. It is also not physically possible for the Block staff to carry out rogueing in all the fields of all Registered Growers. The Team considers that special staff if feasible should be provided for rogueing the fields of Registered Growers or at any rate to do a check rogueing. The Team also considers that the normal procedure should be for Registered Growers to rogue the crops and for the extension staff to check and complete the process. The Team recommends that training camps should be held each year to demonstrate to the Registered Growers and the field staff, the identification of off-types for rogueing, the stage of the crop at which rogueing is best done, and the methods to be employed for maintaining purity. This is being done in many States, but all States should organise such training camps.

(2) *Purity of Registered Seed* : For ensuring purity of Registered seed, the Team recommends that the seed should be tested for germination and purity, and the bags containing such tested seed sealed. This practice is followed only in a few States as in Madras. The cultivator can thus buy improved seed of assured quality in sealed bags. Where procurement is done the seal in the bags will serve as a guarantee for purity. It will be necessary to have some additional staff for this purpose, and the procedure is worth the labour and cost involved. The Team therefore recommends that additional staff be provided where necessary, to test Registered seed and seal the bags, according to the staff pattern of each State.

(3) *Standards for purity and germination* : Most States have drawn up specifications for germination and purity of improved seed. The minimum fixed for food grains ranges from 90 to 95 per cent for germination and 95 to 98 per cent for purity in different States. In their publication "Multiplication and distribution of pure seed of improved varieties 1959" the Indian Council of Agricultural Research have suggested the following specifications :—

TABLE IX

I.C.A.R. Specifications for improved seed

	Seed Farm 'A' Class Growers	Seed Farm 'B' Class Growers
Purity not less than	98 per cent	97 per cent

The Madras Government have recently fixed grade standards for improved seed of food grains as below :—

TABLE X

Grade specifications of improved Registered Seed (Food Grain) in Madras 1961

Registered Seed	Per cent
Purity not less than	97
Viability not less than	90
Foreign and inert matter not more than	1½

The Team considers that it is only by fixing specifications for improved seed and following them in actual practice that its quality can be ensured and recommends that all States should prescribe suitable standards.

The germination capacity varies with the type of seed and is generally low for certain types of cotton as MCU 1. In fixing standards for non-food crops, the States may draw up standards and specifications suitable to their conditions and varieties as determined by the Crop Botanists.

For seed potatoes, the standards depend largely on freedom from disease. In this connection, the Team recommends that standards be fixed on the lines drawn up by the Government of Himachal Pradesh to be found in the Report for that State. The standards should take into consideration general characteristics, conformity, under sized or over-sized potatoes and freedom from scab injury or from blight or bacterial infection. The standing crop is examined in Himachal Pradesh and certified only if the stocks are free from degenerating diseases in the growing stage and do not contain more than 2 per cent of leaf roll, severe mosaic and mild mosaic infected plants.

The Team also recommends that the practice of conducting quick germination tests, using tetrazolium bromide as followed in Andhra Pradesh and Madras, may be introduced in all States for paddy and cotton. The technique is particularly useful when a large number of samples have to be sampled and seed tested rapidly. The above test is applicable only to cotton and paddy. The Team, therefore, recommends that research work should be undertaken to find out such quick methods of testing viability of seed in other crops.

Seed Testing Laboratories.

5.4. The Team notes that although many States had made proposals in the Second Five Year Plan for the establishment of Seed Testing Laboratories, the proposals have been deferred mainly from financial considerations. The Team considers that the establishment of seed testing laboratories is a necessary concomitant to the continued maintenance of purity of improved seed. Seed certification and seed legislation are now in vogue in the more progressive countries of the world and there are technical personnel to ensure that the specifications for certification are strictly followed. The Ford Foundation in its Report on "India's Food Crisis and Steps to meet" has emphasised the need for such laboratories and even the creation of a special cadre of "Seed Specialists" at the Centre and at the State levels. In India seed testing laboratories are now operating in some States only for vegetable seeds but with some enlargement these could be utilised for other crops as well. It is high time that the States where seed work is comparatively more advanced should establish such laboratories in the Third Five Year Plan period. Seed testing is a science and there are many problems in seed multiplication and distribution, where research can suggest ways and means of improving the technique. These laboratories when established can take over the analysis and testing of samples of Registered seed distributed in large quantities. This step, the Team considers, is very necessary as complaints have been made to them regarding the quality of both Foundation and Registered seed. The Team therefore recommends that seed testing laboratories at least one for each State be established. Perhaps, a beginning can be made with some States like Madras, Maharashtra, Punjab, West Bengal etc.

Treating Seed before distribution.

5.5. With the introduction of the "Japanese method of paddy cultivation", the practice of pre-treating paddy seeds with salt solution and Agrosan is followed in many States. *Jowar* seed is also treated with sulphur before sowing. In Maharashtra, pretreatment of paddy and *jowar* seed is being followed for seed directly distributed to farmers from Research stations. Paddy seed is steeped in salt solution to eliminate light seed. The heavy seed is then dried, cleaned, treated with Agrosan and bagged in cloth bags each containing 20 lbs. of seed, just the required quantity to plant an acre. In *jowar,* seed is treated with sulphur and distributed in cloth bags each containing 6 lbs. of seed and sufficient to plant an acre. The Team was informed that there was a good demand for such seed, even when they are priced at as high as Rs. 7 per maund as against a market price of about Rs. 4.50. Although many *ryots* complained to the Team about the high price, about 150 tons have been sold last year to serve about 15,000 Growers. The main advantage of such treated seeds is that the crops raised from them have exceptionally good stand, uniform growth and freedom from seed-borne diseases which no doubt impress the grower.

The Team recommends that this practice of treating the seed from Research stations and despatching to some of the Registered Growers may be followed in other States. The Team recommends that in the beginning such treated seed may be sold at cost price to demonstrate to the *ryots* the benefits of good seed.

Storage facilities.

5.6. At the rate of one store for each seed farm, the eight States of Maharashtra, Madras, Mysore, Himachal Pradesh, Rajasthan, Punjab, West Bengal and Madhya Pradesh would require 1,667 such stores. Since most of the farms are of a larger size than the prescribed minimum of 25 acres, there will be only 876 farms and the number of seed stores required will also be 876. Against this requirement the number of seed stores actually constructed in the Second Five Year Plan was 458. The required number of stores have been more or less constructed in Rajasthan and Punjab, but the progress has been slow in Mysore and Madras. The Team recommends that the full requirements of stores should be provided before the end of the Third Five Year Plan.

In regard to storage accommodation outside the State Seed Farms godowns are being constructed under the Community Development grants and by Co-operative Societies and the State Warehousing Corporations and those under the last category are meant for storing grain and not seed. In its enquiries, the Team found that there was a shortage of suitable storage accommodation particularly in the villages. One of the reasons why Registered Growers are not able to stock the seed for later sale to farmers was lack of storage facilities. The Team finds that the storage accommodation for Foundation seed can be more or less adequate at the stores in seed farms or in the godowns provided for this purpose by the C.D. Blocks. It is in the case of Registered seed produced in the villages that there are no adequate storage facilities. Even if half the quantity of Registered seed required for saturation once in five years is to be stocked, it will require a storage capacity of nearly 5,00,000 tons in India, or roughly 3,500 godowns of 200 tons capacity each.

In the development of improved seed in future, the Registered Growers will play an important role, under the control of the *Panchayats,* and possibly also by Co-operative Societies. It is worthwhile examining the possibilities of introducing small seed bins for the Registered Growers, to stock their seed. There are effective and efficient seed bins already in use by progressive farmers in the villages. The use of such bins on a larger scale has to be encouraged. Since such bins can meet one of the chief handicaps in seed distribution, the Team emphasises the need for providing in the Third Five Year Plan more storage accommodation in the villages and in the case of the Registered Growers, it should be possible for the Co-operative Departments to advance loans towards this purpose.

Threshing Floors.

5.7. Many of the State Seed Farms had no hard threshing floors. To maintain purity of seed both threshing and drying must be done on hard, raised masonry floors. *Kachcha* floors were often improvised for the purpose. In paddy areas, where there is a chance of damage through flooding by rains, as in West Bengal and Kerala and coastal areas of all States, the threshing floors should be constructed on raised ground. It may be useful to cover at least half the area of the threshing floors to safeguard against damage by rains. The Team therefore recommends that hard, raised threshing floor should be provided for every State Seed Farm, by the Third Five Year Plan period.

Residential quarters on Seed Farms.

5.8. The Team also finds that suitable living accommodation have not been provided for the Farm Manager and staff in the State Seed Farms and many of them are stationed in remote villages without adequate amenities. Often the seed farms are located well outside villages and towns. The Team therefore recommends that suitable living accommodations should be provided for the farm staff. In Rajasthan, particular attention is paid to this aspect, but in most other States the problem has been overlooked. The Team would like to draw attention to this important point and recommend the provision of the amenities at least in such of the farms which are situated far away from towns, if necessary, with the Centre's help.

Precautions for maintenance of the quality of Seed.

5.9. Many precautions have to be taken in all the stages of seed multiplication and storage to keep the seed pure and free from attacks by insects and disease. Some precautionary measures are followed and others not. Their importance cannot be over-emphasised. The main precautions to be taken at the different stages of seed production are summarised below :—

1. *Breeder's Stage* :
    (1) The cycle of seeds should be started every year from self-fed plants.
    (2) An adequate border should be insisted on for each crop and only the crops with a reasonable border should be harvested separately for use as seed, rejecting the borders.
2. *Foundation Stage* :
    (1) The number of varieties grown should be restricted to the minimum, but where more than one variety is grown the plots should be separated and sufficient border provided for rejection during harvest.
    (2) Only the first threshed seed should be utilised for seed purposes.
    (3) Hard raised threshing floor should be used for threshing and drying.
3. *Registered Stage* :
    (1) Only one variety should normally be grown in a season and the crop should be harvested for seed leaving out sufficient border.
4. *Seeds* :
    (1) The seeds should be dried thoroughly and the moisture content should in no case, exceed 12 per cent in stored seed. They should be winnowed and properly cleaned if possible, with mechanical winnowers. Grading and sieving equipment should be provided.
    (2) New bags for storage should be used every time and each variety stored separately.
    (3) All containers, equipment, machinery, threshing floor and godown should be thoroughly cleaned before use.
    (4) The bags containing the seeds should be sealed and provided with labels with full particulars.
    (5) The godowns and bags should be dusted periodically with insecticides, to prevent insect damage.
    (6) The godowns should be made rat-proof and damp proof. Although some of the precautions appear commonplace, the Team found in the centres visited that many of them are not observed at all. The Team therefore emphasises that the above precautions should be adopted in all States as a general routine. Necessary facilities and equipment should be provided in all the seed farms.

CHAPTER VI

PRIORITIES IN THE PROGRAMME AND ITS PHASING FROM TIME TO TIME

Progress and assessment of achievement.

6.1. In determining priorities for the Third Five Year Plan, it wil be necessary to assess the present programme and achievements. Fron the data supplied by the different States, the quantities of Foundatioı and Registered seed distributed in 1959-60 were as below :

TABLE XI

Distribution of Foundation and Registered Seed (Tons) of food grains in important States (1959-60)

Crop	Foundation Seed		Registered Seed	
	Target	Achievement	Target	Achievement
Cereals	41,051	17,883	5,64,790	1,22,338
Gram and Pulses	8,211	1,175	82,600	5,400

Assessment of increased yields due to the State Seed Farms.

6.2. Based on the yardsticks assumed by the States for increasec production due to improved varieties for each crop, the estimatec increase in food production for the principal States of India fo 1959-60 were as follow :

TABLE XII

Estimated increased production (tons) of food grains due to improve seeds from State Seed Farms (1959-60)

Rice	3,08,700
Wheat	87,370
Other Cereals	35,610
Total Cereals	4,31,680
Gram and Pulses	8,100
Total Food Grains	4,39,780

The State Seed Farms went into significant production only fror the year 1958-59, and the effective increase in production can be takeı as applicable only for the last two years of the Second Five Year Plar On this basis, the increased production due to the State Seed Farn scheme, and the Registered seed distributed to cultivators therefron is estimated to be of the order of 8,63,360 tons of cereals and 16,20 tons of gram and pulses in the Second Five Year Plan period.

Priorities.

6.3. The Team considers that the quantities of Foundation seed distributed by the State Farms though short of targets (only 44 per cent) have justified the introduction of the scheme. The annual increase in production is now of the order of 4.41 lakh tons of food grains and it is likely to increase further. Priority should therefore be given in the State Seed Farms to utilize the full cultivable area and maximise production through irrigation, manuring and improved cultural practices. This can also improve their financial condition.

(1) The Team notes that only 21 per cent of the targets of seed for food grains has been distributed. Even the current production of Registered seed is not fully distributed in Mysore and Maharashtra. The Team therefore recommends that the highest priority should be given in the Third Five Year Plan for the intensification of the distribution programme for Registered seed particularly of food grains, in each village by Registered Growers with the help of village *panchayats*.

(2) The small millets, oil seeds and pulses have not received much attention either in research or extension. A comprehensive seed multiplication programme is yet to be drawn up for these crops in many States. Priority should therefore be given for them in the Third Five Year Plan. Further, until such time as more suitable varieties are evolved, the appropriate course will be to multiply improved seeds of the already introduced ones to the maximum extent possible. Many of these crops have a low seed rate and high multiplying rate and can be expanded directly even from the Foundation seed stage. This applies to *jowar, bajra, ragi,* small millets, *til,* rape and mustard, castor and linseed.

(3) The pulses should also receive priority in the Third Five Year Plan as they contribute to the most valuable necessity in human diet, namely, protein. The present coverage is small and any expansion of the area under improved varieties can make a substantial contribution to increased food production. At present there is no other means by which increased production can be effected in them. They are mostly grown as rainfed crops in poor class of land and do not receive much attention either by intensive cultivation or irrigation. The multiplying rate is lower than that of many cereals, but this is not a serious obstacle as they can be raised freely as mixed crops or as catch crops after cereals. The Foundation seed of all available pulses should be raised to a maximum and the distribution effected on a large scale.

(4) There are special problems in the seed multiplication of groundnut, gram and wheat due to high seed rates and low multiplication rate in rainfed areas. In irrigated lands it is possible to expand seed multiplication to meet targets with one class of Registered Growers, as for wheat in the Punjab. But when, in a State, the area is large under rainfed conditions, it will not be possible to cover the area with improved seeds of these crops within a reasonable time unless

the area under the seed farms is increased and a second class 'B' of Registered Growers is introduced. On account of the comparatively low spread of these crops in all the States, the Team recommends that their seed multiplication should receive priority in the Third Five Year Plan through the establishment of large seed farms and, where necessary by the provision of one more class of Registered Growers.

Comprehensive State-wise trials.

6.4. One noticeable feature of the extent of coverage by improved varieties in India is the comparatively small spread even in such crops as rice and wheat which have received more attention both in research and extension for the last 3-4 decades. In paddy this is attributable partly to the distribution of unsuitable varieties in certain areas and also to the lack of adequate information demarcating suitable areas for the existing varieties. The Team would therefore emphasize that high priority should be given to the undertaking in each State of comprehensive trials of outstanding local varieties and also those obtained from outside the State. In the case of rice it should be possible to include also some of the promising derivatives of the *Indica-Japonica* crosses which have potentialities for both high yields and wide adaptability. Day-neutral, early maturing varieties, like TKM 6, may also be included in such trials.

The Team notes that the so called district trials in many States are no better than demonstration plots. There are no replications and the usual technique necessary for varietal trials not followed. The Team recommends that these State trials should be conducted in a more scientific manner, with help from technical staff, where necessary. There are over 900 improved varieties of crops in India and it is only by comprehensive State trials over a wide range of conditions that we can assess their full potentialities and select the promising varieties to implement an effective seed programme. The Team, therefore, considers that comprehensive State trials of improved varieties of important crops should have a high priority in the Third Five Year Plan.

CHAPTER VII

ADMINISTRATION AND CO-ORDINATION SET-UP OF THE AGRICULTURAL DEPARTMENT

Research.

7.1. Research work for improved seeds in India is undertaken mainly in the States. The extension namely, the spread of the improved seeds is also the primary concern of the States. There are, however, certain crops for which the Centre has taken up extensive breeding work to tackle special problems as for example, rust in wheat, virus diseases in potatoes, the flowering factor in sugarcane, fundamental studies in rice, hybrid vigour in maize etc. A large number of outstanding varieties have been released as a result of such work. Even when new varieties become available as a result of work in the centre the determination of their suitability to local conditions and if necessary, their spread also form the function of the States.

The research work on radiation genetics and mutation breeding is being carried out in the Centre and the treated material is tested in the Research Stations of the States. The Centre has also substations in the States for certain crops such as wheat, potatoes and hybrid maize. The Indian Central Commodity Committees are financing a number of special breeding and seed multiplication schemes in the States for sugarcane, cotton and oil seeds and there are also schemes in the States financed by the Indian Council of Agricultural Research. Recently a multi-crop Central Research Project has been introduced for regional research on cotton, oilseeds and millets (PIRRCOM) which has eight main stations and ten substations distributed in several States. It was brought to the notice of the Team that there were difficulties in co-ordinating work in the States and in the Central Stations particularly when both are located at the same place.

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The number of Agricultural Research Stations and Farms in India engaged on the breeding of improved varieties excluding fruits and plantation crops, or for multiplication of their seeds, was about 425 in 1959-60. Many of them deal with more than one crop and are of the general type. These grouped crop-wise, give 136 stations dealing with rice, 127 with wheat, 96 with millets, 88 with cotton and 63 with sugarcane, but many of them are doing only general multiplication work and the stations engaged in research are only comparatively few. The designations given to these Farms and Stations vary in different States, though the type of work undertaken may not be different. In Jammu-Kashmir and Bihar, the Farms are called District Farms and sub-Divisional or *taluka* Farms. There are farms exclusively called Seed Multiplication Farms in Orissa and West Bengal; farms designated as Seed-*cum*-Demonstration Farms in

Maharashtra, Punjab and West Bengal; farms called Demonstration-*cum*-Research Farms in Andhra and others called Seed-*cum*-Research Farms in Mysore. The designation, Agricultural Research Station, is most commonly used in many States and in these both breeding and agronomic work are carried out for the crops of the region. In some States they are called Government Experimental Farms or Regional Research Stations.

7.2. Research on plant breeding is mostly carried on in the main stations under the control of Crop Specialists, or Economic Botanists. The term, Crop Specialist, is used in Madras, Mysore, Andhra Pradesh and Maharashtra and the term Economic Botanist in the other States. Usually, the Economic Botanist deals with more than one crop and occasionally he may also deal only with one crop. With the recent advances in science and the need for specialisation, there is need for very intensive research on each crop including breeding, agronomic, chemical and plant protection aspects. Isolation of an improved variety is not an end in itself. Information is necessary on its optimum requirement of soil fertility, agronomic features, its reaction to important pests and diseases, etc. The lines of work cannot be carried on in isolation and there must be a co-ordinated attack from different angles. Best results are therefore obtainable only when all aspects of work are properly integrated at every research centre. It is this aspect that has led to the recommendation to be adopted in the Third Five Year Plan of appointing Crop Specialists with Central Research Stations which should also have Specialists to deal with agronomic, chemical, physiological and plant protection work in the crop. The Team fully endorses this principle to be followed wherever possible in future work.

Pattern of Administration.

7.3. Under the Director of Agriculture of each State there are in all States Joint Directors with assigned portfolios such as Research, Research and Education, Seed work, Extension, Engineering etc., the number varying in different States. Groups of Districts called Divisions or Regions are in charge of Deputy Directors of Agriculture. In Maharashtra, this work is entrusted to an officer of higher rank called the Superintending Agricultural Officer, under whom works the Deputy Director of Agriculture (Research) and the District and Regional Staff. The States are divided into districts and each district has a District Agricultural Officer, sometimes also called Superintendent of Agriculture. Formerly, there were for each *Taluka* or *Tahsil* a non-gazetted officer variously designated as the Agricultural Demonstrator, or Agricultural Inspector, or Supervisor, in different States. With the establishment of Community Development and National Extension Blocks, each Block is provided with an Agricultural Extension Officer with field staff and Village Level Workers. Subject Specialists of the same rank have also been added on in many States. In the areas, where Blocks have not yet been established, the old arrangements continue. The Agricultural Extension Officer and Demonstrators are usually graduates, but in States where Agricultural Schools exist, diploma holders from these institutions are employed on a lower grade of salary under or in place of graduates. Due to non-availability of graduates, many of the Seed Farms are in charge of these diploma holders.

The important Agricultural Research Stations are in charge of Superintendents of Gazetted rank and the smaller ones under Research Assistants in the subordinate rank. Usually, the Crop Specialist or Economic Botanist has one or more Assistant Crop Specialists (or Botanists), under whom the Research Assistants work. In most States, in the Central Research Institute or College, the Chemistry, Botany, Crop Breeding, Mycology and Entomology wings act as separate independent units. Crop Specialists usually have their own Central Research Stations at their headquarters. There may also be a number of sub-stations in the districts or regions of the State which may be either directly under the Crop Specialists or under the Deputy Director of Agriculture and in the latter case the specialists have their own technical staff located at these sub-Stations.

Co-ordination of Research.

7.4. With farms of varying pattern such as the Agricultural Research Stations, School and College Farms, Demonstration Farms and the Seed Multiplication Farms, the standard of research or scientific work is very variable. Many States make a distinction between Specialist's Farms and Deputy Director's Farms, and the distinction is also carried higher up between Central and State Research. In plant breeding work in the States, research should be of the highest standard, and fundamental research is also necessary for without it, the standard in research will fall in quality. The Team therefore recommends that a greater uniformity of functions may be assigned to the Farms in the State, so that there are generally three classes namely (i) the main Research Institutes or Central Stations of Crop Specialists; (ii) Crop Research sub-stations; and (iii) the Agricultural Research Stations. The better ones among the demonstration farms could be raised to the level of the Agricultural Research Stations, which can undertake agronomic and regional research work.

The Team also recommends that the State Seed Farms should also serve as demonstration farms for demonstrating the benefits accruing from improved agricultural practices; the old seed multiplication farms should be brought to the same status as State Seed Farm and utilized for production of Foundation seed.

Large farms and mechanised farms in the States.

7.5. There are many Government farms of over 1,000 acres in size and some of them are mechanised as in Uttar Pradesh, Rajasthan and Jammu-Kashmir. The question has been raised as to how far these farms can be utilised in Seed Multiplication Schemes. Complaints were made to the Team regarding the quality of seed produced at the mechanised Farm in Suratgarh, Rajasthan. In some States, the larger farms are used for one more stage of multiplication. In one case the Breeder's seed from the Research Station is first sent to the large farm for multiplication and the seed thus multiplied distributed to the State Seed Farms. In another case, the reverse practice was followed, whereby seed from the State Seed Farm was multiplied in the large farms and then sent to the Registered Growers. The Team considers that in either case one year is lost in the programme of multiplication. The Team therefore considers that portions of the larger farms should be used for raising Breeder's seed so that all the seed farms large and small, get a continuous and adequate supply of breeder's seed from which Foundation seed is raised. The larger farms could also be used to increase the supply of Registered seed. The only requirement will be to ensure technical supervision. In regard to mechanised farms the Team also found damaged and broken seeds such as in the case of wheat from mechanical threshing. The Team considers that the Block pattern or *Taluka* pattern of State Seed Farms in workable sizes should be the normal type for seed multiplication and these large or mechanised farms could be used to raise seeds of crops which have a low multiplying power such as *barani* wheat, groundnut, gram etc. which cannot be raised in sufficient quantity in State Seed Farms. Adequate precautions should, however, be taken to maintain purity, by supply of pure seed and by exercising careful supervision of seed quality at all the stages. There is no doubt that the mechanised farms could be utilized for producing Registered or certified seed. In that case, the supply could go directly to farmers. It should, however, be necessary as mentioned in the case of large seed farms in States to provide technical supervision in sowing, rogueing and harvesting. Mechanical threshing may damage seed but this can be avoided by adjustment and threshing seed crop first. A good cleaning can also remove broken grains.

Importance of hybridization in research work.

7.6. With the progress of pure line breeding for the past several years of research, the stage has been reached in the major crops in the country when the scope for any further advance by this method must be considered limited. The Team would therefore emphasize the importance of hybridization in future crop breeding work. Though phenomenal success has been achieved by hybridization in sugarcane and to lesser extent in wheat, cotton and rice, the possibilities in other crops have not been fully exploited. In paddy, the most important food crop, the evolution of blast resistant types, e.g., C0 25 of Madras is an outstanding example of successful hybridization work. Similarly the evolution of TKM 6, a day neutral early maturing variety with good yield and fine quality of grain is another successful example. They show the possibilities and also the necessity for intensifying hybridization work. The co-ordinated project of hybridization between *indicas* to which all Indian rice varieties belong, with varieties from Japan and Indonesia is being initiated in all States has enormous possibilities to obtain varieties having the most desirable features, namely strong straws, greater response to fertilization, less sensitivity, to day length and earliness in maturity period. In wheat, valuable varieties have been obtained having resistance to the most important disease of the crop, rust. Similarly new varieties of cotton, American and *desi,* have been built by hybridization with long staple and also high ginning qualities. Recent advances in sister sciences have provided new tools and techniques to the breeder. The time is propitious to intensify breeding research so that new varieties of food and industrial crops can be produced to meet the increasing and varying needs of the country. Advance in the science of genetics made the production of hybrid maize possible and India has also begun to make use of the knowledge to increase maize production in the country. The same technique has shown the way to increase production in *bajra* and also in *jowar* but the technique has to be developed for a large scale commercial production of hybrid seed in these crops as in maize. Among the tools available to the breeder, use of ionizing radiation to produce mutations can also fully play a part. The Team would therefore stress the necessity for intensifying hybridization in future plant breeding work and more research into the genetics of crops.

The staffing pattern for work on improved seeds.

7.7. The work of multiplying and distributing improved seed is the normal function of the Agricultural Departments and would continue to remain so. The Team, however, considers that the work of improved seed should be strengthened in different stages so that the implementation of the seed distribution programme is rendered effective. The objective of saturating the entire area of important crops with improved varieties cannot be reached unless there is an effective agency to direct the seed programme from the research stage to the multiplication through the seed farms and Registered Growers and finally to the distribution of seed to the *ryots*. In the larger States, a large quantity of improved seeds, of the order of 30,000 to 50,000 tons per year of various categories of crops, has to be handled and the quality ensured. This requires both technical and organizational control and a capacity to implement a large scale programme, utilizing the knowledge on varieties to a wide range of conditions and regions. For this purpose the Team recommends that in all the large States one officer of the status of Joint Director of Agriculture should be exclusively appointed to direct and organize the seed multiplication work and co-ordinate the work of research with the State Seed Farms and distribution of Registered seed.

(1) The Team also notes that the work of seed multiplication has received only casual attention in some States, and the question of

quality control associated with the work has been neglected. Such control cannot be done without additions to the existing staff. The Team also considers that while the multiplication and distribution of seed can be undertaken by the usual extension staff, there should be complementary organization to help in the maintenance of quality and purity. Testing purity and viability has to be done as a special undertaking and not by the regular extension staff. In order to undertake all this work, the Team recommends that, at the district level, a technical assistant may be employed under the District Agricultural Officer to check and arrange the seed supply of the required varieties, check upon the rogueing work carried out in the Village Seed Farms and test the seeds for viability and purity at all stages. Mention has also been made earlier of the need for comprehensive State-wise trials of varieties in a scientific manner to decide on the suitability of varieties to meet the cultivator's needs. The Technical Assistants proposed can attend also to this work.

(2) *Special Officers for seed* : The Ford Foundation, in its publication "India's Food Crisis and How to Meet it" has emphasised the need for a separate category of seed specialists at the Centre and in the States, with technical equipment and staff. As seed work expands in India, this will be a natural development. At the present state of seed development work in India, where seed laws and certification have not been introduced, the Team recommends that seed testing laboratories may be established in each State as a first step and the work of improved seed be intensified by employing well qualified technical officers at the Divisional level for supervision of maintenance of the quality of seeds supplied and for selecting the varieties best suited for different regions. Such officers, called "Seed Development Officers" are already employed in some States under the Regional Deputy Director of Agriculture. The Team therefore recommends that a technical officer of the gazetted rank be employed at the Divisional level in all States to facilitate the supply of guaranteed seed of improved varieties to different areas on a planned basis and thereby improve the effectiveness of seed multiplication and distribution work.

(3) *Research and Education* : For proper co-ordination between the research work in the Colleges and the work of plant breeding, teaching of genetics in the Colleges should receive greater consideration than now. That extension should be integrated with teaching in Colleges has come to be recognized only recently. To meet the increasing demand for agricultural graduates, admissions to old Colleges have been increased and new colleges have also been established. The Team had an opportunity to visit some of the newly established institutions and in their opinion the position was not satisfactory. There was no proper integration of research and teaching and the personnel and equipment were not also of sufficient standard. Steps would have to be taken to improve the conditions in these new institutions so that graduates passing out of them are of a good

standard to occupy responsible positions. Turning of more graduates to meet the demand should in the opinion of the Team mean lowering of standard in the Colleges. While all Colleges can with reasonable facilities, turn out graduates, only a selected few where special facilities and personnel can be ensured should provide for post graduate training. It is on the right standard of post graduate training available that future development of agricultural research in the country can depend.

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SUMMARY OF RECOMMENDATIONS

I. Research.

(1) For all important crops in each State, there should be a separate Crop Specialist or Economic Botanist devoting his entire attention to each crop with a Central and a number of Regional Stations, where all aspects of research, breeding, agronomy, plant protection, statistics etc., could be undertaken.

The pattern of research organisation should be to co-ordinate breeding research of a Crop Specialist or Economic Botanist with work in other branches like agronomy, chemistry, plant protection and statistics by provision of technical personnel for such work in all Central Stations. **(2.2 & 7.2).**

(2) With the objective of a full saturation by improved varieties of food crops in the Third Five Year Plan period, emphasis should be on intensifying breeding research on these crops. The States and the crops where there is need for such intensification are given below:—

Crops	States
Rainfed *Jowar*	Madhya Pradesh, Rajasthan and South Madras.
Kharif Jowar	South Maharashtra and Mysore.
Paddy	Saline and deep water areas of all States.
Barley	Madhya Pradesh, Rajasthan and Himachal Pradesh.
Bajra	Rajasthan, Maharashtra, Gujrat, Uttar Pradesh, Mysore and Andhra Pradesh.
Hybrid Maize	All maize growing areas.
Ragi	Bihar, Uttar Pradesh and rainfed areas in Madras and Maharashtra.
Minor oilseeds	All States.
Small Millets	All States.
Gram and Pulses	All States

(3) With the progress of work for the past fifty years in pure line selection in major crops a stage has been reached when the scope for further advance by this method must be considered limited. More attention should, therefore, be given to hybridization in fututre crop breeding research and the utilization of hybrid vigour in particular crops. Fundamental research in plant genetics and plant breeding should be intensified to investigate the possibilities of combining high yields with many other desirable features. Among the tools available to the breeder, ionizing radiation to produce useful mutations can also play its part. **(2.5 & 7.6).**

(4) The following recommendations are made in regard to work on individual crops :—

(i) In areas where no suitable strains have been evolved the best among the local varieties or selected bulks may be released in the first instance, in the following cases :

- (a) paddy in saline or water logged areas;
- (b) millets in rainfed areas; and
- (c) pulses and oilseeds.

(2.3 & 3.1).

(ii) Day-neutral cosmopolitan varieties of rice with shorter maturity periods should be evolved. (2.4).

(iii) The number of varieties of paddy now being distributed appears too many in Andhra Pradesh, Mysore, Madras, West Bengal etc. To demarcate suitable areas for each variety and also to reduce the number of varieties, systematic State-wise variety trials should be undertaken. [2.3.(1) & 6.4].

Similarly the number of wheat varieties under distribution should be reduced to the minimum, as for example in Madhya Pradesh. Greater attention has to be paid to the evolution of hard wheats required in Rajasthan and Mysore. [2.3.(2)].

(iv) As a male sterile parent of *jowar* is available, a programme of research to produce hybrid sorghum should be undertaken in States with large *jowar* areas, such as Maharashtra, Mysore, Andhra and Madras. This work has got large potentialities for increasing production in this crop. [2.3.(3)].

(v) In hybrid maize the outstanding flintish types which have yielded well in recent trials should be more extensively tested in all maize areas and arrangements made to produce the most suitable ones for the particular areas. The four promising flint hybrids from the All-India Maize Hybridization Scheme should be extensively tested in all maize areas. [2.3.(5)].

(vi) A main research station for *bajra* should be established in Rajasthan. [2.3.(4) & 3.4.(3)].

(vii) More research is needed in rainfed groundnut to overcome seed dormancy and the incidence of *tikka* disease.

[2.3.(11)].

(viii) The objective in future cotton research should be to produce by hybridization new varieties with 1 staple for rainfed areas and $1\frac{1}{4}''$ for irrigated areas. Work on sea-island cotton should be intensified to evolve types resistant to *black arm* and also investigation pursued to determine optimum cultural practices for successfully growing the crop. [2.3.(13)].

(ix) In sugarcane research, greater attention should be paid not only to tonnage but also higher recovery of sugar as the All-India average for this is still low. [2.3.(14)].

(x) Potato research should be directed towards evolution of hard starchy varieties required in the importing States of Maharashtra and Mysore. [2.3.(15)].

(5) The genetic identity of improved varieties should be maintrained by starting the cycle of multiplication from self-fed plants every year at least once in 2-3 years for all crops, including the self-fertilized ones. (5.2).

(6) Even in major food crops, such as rice and wheat which have received greater attention than other crops during the last 40–50 years the coverage by improved varieties is only about 40 per cent of the total area under them. This may be partly due to introduction of unsuitable varieties in particular areas. The Team, therefore, recommends a State-wise and inter-State trials of all outstanding varieties in each State along with introductions from other States and abroad to explore the potentialities of these varieties. Such trials in paddy should include the *Indo-Japonica* derivatives, which have a great range of adaptability and also the day-neutral types with short maturity periods. The State trials should be conducted more scientifically with replications including high and low fertility conditions so that the varieties more responsive to fertilization can be marked out. This work should receive high priority in the Third Five Year Plan. (6.4).

II. Seed Multiplication.

(1) An intensive seed multiplication programme with the available improved varieties should be carried out for millets, *til*, castor, rape and mustard in the State Seed Farms, as a large area can be covered by them even from the Foundation stage, due to a high multiplying factor. [2.3.(12); 3.1 & 6.3.(2)].

(2) As the present production of Foundation seed is small for pulses and the area covered with improved seed is negligible, the available improved varieties of these should, wherever feasible, be raised as mixed crops and as second crops in wet lands on a large scale and an extensive seed distribution programme implemented. [2.3.(10) & 6.3.(3)].

(3) As the production of Breeder's seed in wheat, gram, groundnut and pulses is short of requirements in many States as also of rice in West Bengal, steps should be taken to produce the required quantities in Research Farms or in other Government Farms under the control of the Crop Specialists. [2.3; 3.4.(1); 4.8 & 3.5].

(4) Improved seeds of inter-State varieties of all crops listed in this Report should be multiplied in greater quantities in their original homes to cater to the needs of other States as and when the need arises. (2.4).

(5) In the States which have not yet drawn up an adequate distribution programme for improved seed, a planning of seed multiplication and distribution to cover the area of all important crops

over a period of five years must be drawn up and the necessary seed farms established to produce adequate Foundation seed. (1.3 & 1.4).

(6) The fullest use should be made of facilities such as manuring and irrigation in State Seed Farms to maximise production. In all Seed Farms the average yield per acre should be increased by at least 20 per cent over the Second Five Year Plan. The progress towards bringing into full cultivation of the area of the existing State Seed Farms in some States should receive special attention as high cropping efficiency can reduce losses. **[1.4; 3.4; 4.2.(5) & 6.3].**

(7) The occurrence of large losses in the State Seed Farms should be examined and steps taken to improve their economics particularly in Madhya Pradesh and Rajasthan.

(8) In States where the present area is inadequate, sufficient area for State Farms should be acquired or reclaimed to produce enough seed which when multiplied can cover annually one-fifth of the area in the case of all self-fertilized crops and the aim should be to cover the entire area for the cross-pollinated ones in the Third Five Year Plan period. In giving effect to the above the existing resources of land, irrigation and production should be fully examined and new farms should be brought only to the minimum extent necessary. **[1.4(d) & 4.2.(2)].**

(9) On account of the comparatively low coverage in groundnut, gram and wheat of rainfed areas, enough seed of these should be multiplied through large seed farms and where necessary through one more class of Registered Growers. **[2.4; 3.4.(4) & 6.3.(4)].**

(10) The economic size of a seed farm capable of meeting establishment charges and interest on capital should be at least 50 acres in irrigated lands, and 100 acres in unirrigated areas. The seed farms proposed to be started in the Third Five Year Plan should be of the minimum size of 50 acres, and the existing smaller farms should be enlarged to make up this area. **[4.2.(3)].**

(11) The practice of taking lands on lease for establishing Seed Farms obtaining in some States may be discontinued as this leads invariably to losses. **[4.2.(4)].**

III. Seed Distribution.

(1) The main handicap in the coverage by improved varieties is the poor distribution of Registered seed. Only small quantities ranging from 5 to 20 per cent of the targets is distributed. Highest priority should therefore be given to this in the Third Five Year Plan. For the above purpose each village should be taken as the unit for seed work, and the distribution programme intensified in every village by Registered Growers with the help of Village *Panchayats*. The Team recommends that seed distribution work may be entrusted to *Gram Panchayats* with selected Registered Growers, acting as *'Gram-sahayaks'*, who can be given a premium of Rs. 2 per maund of seed actually distributed. **[4.6 & 6.3.(1)].**

The Co-operative Societies may be associated with the work wherever they are willing or are in a position to undertake the work particularly for granting loans to the poorer classes of farmers to buy seed. (4.4).

(2) The Registered Growers must be limited to only one class as far as possible. However, in States where the rainfed area is large under crops with low multiplying rate such as groundnut, gram and wheat the classes may be increased to two. (1.4).

(3) A random sampling survey of coverage of improved varieties in all important crops in each State should be conducted through field staff under the guidance of the State Statistician. This survey should synchronise with the Five Year Plan periods, while the estimate of such coverage should be conducted every year and published in the annual administration Reports. It should be feasible to collect the information on all important crops in one survey. The term "improved strain" should include only areas where the seed has been renewed from a recognized source within a period of five years of the survey. The information so collected should be used in the future planning of improved seed distribution for each State. [3.2.(3)].

(4) The estimated cost of production of a maund of hybrid maize seed by the All-India Seed Corporation Scheme is around Rs. 40 as against a cost of Rs. 25 per maund of this seed produced in decentralized small units run by the Vivekananda Laboratory at Almora. Since the cost of hybrid maize seed distributed to the farmers is an important consideration, the Team suggests that leading maize experts should meet and examine the various methods including the one evolved at Almora and find out how the cost of hybrid maize seed could be lowered. **[3.4.(5)].**

(5) The distribution of improved seed of cotton in rainfed areas should receive particular attention as the coverage is relatively much smaller than in irrigated cotton. [3.4.(12)].

(6) The system of exchange in kind of improved seed with *ryot's* seed by the Agricultural Departments may be replaced by grant of loans for seed in the form of *taccavi* or from Co-operative Societies. **[4.3.(4)].**

(7) Every Registered Grower should be made to keep a record of his transactions mentioning the quantities and varieties of improved seed sold or exchanged by him with other *ryots.* (4.5).

There should be a provision to see that the Registered Grower, does make full use of the seed supplied to him. (5.1).

IV. Maintenance of Quality.

(1) All States should prescribe suitable schedule for improved seed of each important crop with specifications for purity and germination and for refractions so that the quality is maintained. [5.3.(3)].

(2) All precautions should be taken for maintaining the crop pure on the field and for keeping the seed dry and free from admixture or insect attack in godowns. Samples of seed from State Seed Farms should be checked periodically by the Specialist staff who may also inspect the standing crop of seed farms. Mechanical equipment for cleaning, winnowing and processing improved seed may be introduced in Government Farms. **[5.3.(9)]**.

(3) To maintain purity of seed at threshing and drying, hard raised threshing floors should be provided in every State Seed Farm during the Third Five Year Plan period. **(5.8)**.

(4) More storage accommodation should be provided for the Registered Growers in the villages and the Co-operative Department should provide loans for this purpose to the Registered Growers. Use of satisfactory seed bins by the Registered Growers for stocking seed should be encouraged. **(5.6)**.

(5) A beginning can be made in the States of pretreating paddy seed in salt solution and with Agrosan and supplying to farmers direct from Government Farms at cost price. Similarly *jowar* seed pretreated with sulphur may also be issued. This will educate the *ryots* about the value of treated seed. (5.5).

(6) A system of certification of seed potatoes should be organised in the exporting States and supplies made under the control of the State Department of Agriculture in the importing States. [2.3.(15)].

(7) Steps should be taken to maintain a continuous supply of disease free setts from short crops of sugarcane in all States. [3.4.(13)].

(8) For guaranteeing the purity of the Registered seed, every bag containing tested and approved seed should be sealed. Additional staff should have to be provided for this purpose. [4.5 & 5.3.(1 & 2)].

(9) Training camps should be organized every year to instruct the Registered Growers and the junior field staff about the identification of plants for rogueing, the stage of the crop at which rogueing is best done and the methods to be employed for maintaining purity. **5.3.(1)]**.

(10) Quick viability tests as for instance the use of tetrazolium bromide for the purpose in paddy and cotton in some States may be introduced wherever it is not followed now. Investigations on finding other such quick test in the case of crops may be undertaken. [5.3.(8)].

(11) Seed testing laboratories with regional units should be established in all the large States by the Third Five Year Plan, so that quality control of seed is maintained satisfactorily in the different stages of multiplication and distribution of improved seed. (5.5).

(12) The practice of tenants managing the State Seed Farms in the Punjab is not conducive to the maintenance of purity of seed and

the Team, therefore, recommends that the management of the State Seed Farms in this State should be in line with what obtains in other States. [4.2.(4)].

V. Administration and Co-ordination.

(1) For effectively oragnising supplies of improved seed from the Research Stations, according to needs in different varieties and supervising the work of distribution, an officer of the rank of Joint Director of Agriculture should be appointed in all the large States. (7.7).

(2) At the Divisional level, technical officers, conversant with the technique of improved seed should be provided to select varieties best suited for different regions; arrange the supply of improved seed; check their quality and co-ordinate the work in the districts and C.D. Blocks. [7.7.(2)].

(3) For the correct conduct of district trials and for maintaining the purity of seed at the State Seed Farms and checking the quality of seed with Registered Growers, technical assistance may be provided at the district level, to ensure a guaranteed supply of pure seed to the cultivators. [7.7.(1)].

(4) The Agricultural Stations and Farms are now of many different categories and functions. For uniformity, they may be restricted to three classes : (i) the Research Institute and Central Crop Breeding Stations (ii) Crop Research Sub-Stations (iii) Regional Agricultural Research Stations. The more advanced Demonstration-*cum* Seed Farms may be raised to the level of Regional Research Stations and all other farms put at par with State Seed Farms for raising Foundation seed. (7.4).

(5) Large farms should not be utilised for increasing the stage of multiplication. Small areas in these farms can be used for raising Breeder's seed of crops where necessary under technical supervision and the rest of the area utilized as the State Seed Farms for raising Foundation seed. (7.5).

(6) The State Seed Farms should also serve as demonstration farms to demonstrate the benefits of all improved agricultural practices. (7.4).

(7) The larger seed farms and mechanised farms could be utilized for producing Registered seed in which case the supply could go directly to farmers. It should, however, be necessary in such a case to provide for technical supervision during sowing, rogueing, harvesting and threshing. (7.5).

(8) Suitable living accommodation should be provided to the staff of the Seed Farms, particularly when they are in remote villages without adequate amenities. (5.8).

VI. Agricultural Education.

(1) The number of Agricultural Graduates turned out in the States will not be adequate to meet the needs of Research or Extension in the Third Five Year Plan. The number should be increased in the existing colleges to the extent possible and new colleges where necessary opened to meet the deficiency. [7.7.(3)].

(2) There should be proper co-ordination between research work in colleges and plant breeding work for which teaching of genetics in the colleges should receive greater attention than now. There should also be proper integration of research and teaching and for this there is need to raise the standard of personnel and equipment in the colleges. [7.7.(3)].

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APPENDIX I

Area under crops and percentage of area irrigated in different states of India (1959-60)

State	Rice		Wheat		Bajra		Jowar		Ragi	
	Area Million acres	Percent Irrigated	Area Million acres	Percent Irrigated	Area Million acres	Percent Irrigated	Area Million acres	Percent Irrigated	Area Million acres	Percent Irrigated
1	2	3	4	5	6	7	8	9	10	11
Andhra Pradesh	7·27	90	·04	25	1·60	10	5·99	1	0·76	50
Assam	4·22	33	—	—	—	—	—	—	—	—
Bihar	12·35	30	1·60	13	—	—	—	—	0·49	4
Gujrat	1·20	11	1·00	53	3·40	2	3·40	3	0·21	—
Himachal Pradesh	0·10	50	0·35	14	—	—	—	—	—	—
Jammu & Kashmir	0·50	90	0·30	27	—	—	—	—	—	—
Kerala	1·90	39	—	—	—	—	—	—	—	—
Madhya Pradesh	9·92	12	7·00	6	0·44	—	4·69	—	0·04	—
Madras	5·71	90	—	—	1·23	20	1·75	25	0·86	50
Maharashtra	3·00	21	2·30	14	4·60	2	14·10	4	0·54	2
Mysore	2·40	50	0·75	4	1.20	—	6·16	1	2·60	3
Orissa	9·56	25	—	—	—	—	—	—	0·17	12
Punjab	0·97	50	5·20	50	2·30	12	0·70	26	—	—
Rajasthan	0·25	12	3·00	47	9·90	1	2·62	2	—	—
Uttar Pradesh	10·05	9	9·60	4·3	2·60	1	2·22	1	0·49	—
West Bengal	10·92	25	0·10	50	—	—	—	—	—	—
Total India (including others) ..	81·34	35	31·50	31	27·50	3	41·60	3	6·20	15

APPX. I (contd.)

	Sugarcane		Cotton		Groundnut		Barley		Maize	
1	2	3	4	5	6	7	8	9	10	11
Andhra Pradesh	1·90	90	1·0	1	3·30	3	—	—	0·46	13
Assam	0·06	100	—	—	—	—	—	—	0·04	—
Bihar	0·40	18	—	—	—	—	1·08	12	1·51	—
Gujrat	—	—	4·60	2	2·40	1	—	—	0·49	8
Himachal Pradesh	—	—	—	—	—	—	0·08	12	0·28	7
Jammu & Kashmir	0·04	100	—	—	—	—	0·03	28	0·52	15
Kerala	0·02	50	—	—	—	—	—	—	—	—
Madhya Pradesh	0·13	100	1·90	1	0·82	—	0·42	12	1·06	4
Madras	0·12	90	1·80	23	1·82	8	—	—	0·02	70
Maharashtra	0·25	100	6·50	1	2·80	1	—	—	0·02	—
Mysore	0·13	100	2·80	1	2·20	—	—	—	0·02	80
Orissa	0·07	86	—	—	0·06	—	—	—	0·08	—
Punjab	—	—	1·40	90	0·14	—	0·47	26	1·09	44
Rajasthan	0·80	100	0·60	50	0·14	—	1.42	61	1·24	22
Uttar Pradesh	1·94	63	0·15	67	0·38	—	4·50	40	2·51	18
West Bengal	0·03	50	—	—	—	—	0·16	—	0·17	10
Total India (including others) ..	5·14	66	20·04	10	14·00	1·8	8·22	40	9·49	12

APPENDIX II

General area in acres that can be covered once in five years by one acre of seed Farm with different multiplying rates and classes of Registered Growers.

Crops coming under the group		Multiplying rate	Area covered by class of Registered Growers		
Irrigated	Rainfed		One class 'A'	Two classes 'A' and 'B'	Three classes 'A', 'B', 'C'
Bajra		100	25,000		
Ragi		80	16,000		
Jowar	Bajra	60	9,000		
Rice	Mustard Ragi	50	6,250		
Barley Wheat	Jowar Til	40	4,000		
	Castor	30	2,250		
	Urad Mung	20	1,000		
Cotton	Tur	16	640	5,120	
Groundnut	Barley	14	490	3,430	
	Rice	12	360	2,160	
		10	250	1,250	
	Groundnut Cotton	8	190	640	2,560
	Wheat Gram	6	90	270	810
	Potatoes	5	63	160	400

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NOTE:—If **m** is the multiplying rate, the area that can be covered once in five years by one acre of seed farm with 50% distributed in the Registered stages is $2\frac{1}{2}\ \mathbf{m}^2$ with one class 'A' of Registered Growers.

With two classes 'A' and 'B' of the Registered Growers the area will be $5/4\ \mathbf{m}^3$. Where there are two rates of multiplication from seed farms ($\mathbf{m}_1$) and Registered Growers ($\mathbf{m}_2$), the area covered will be $2\frac{1}{2}\ \mathbf{m}_1\ \mathbf{m}_2$ with one class and $5/4\ \mathbf{m}_1\ \mathbf{m}_2$ with two classes of Registered Growers and so on.

APPENDIX III

Number of Improved Varities of Crops Multiplied in Different States of India (1959-60)

State	Rice	Wheat	Jowar	Bajra	Ragi	Maize	Kora	Other Millets	Barley	Gram	Tur	Mung	Urad	Other Pulses	Groundnut	Til	Castor	Linseed	Rape & Mustard	Other Oil Seeds	Cotton	Sugarcane	Potatoes
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Andhra Pradesh	79	3	23	1	8	5	5	1	—	—	3	3	1	—	3	1	2	—	—	—	12	2	—
Assam	18	—	—	—	—	—	—	—	—	—	1	1	1	—	—	—	—	—	1	—	—	3	—
West Bengal	41	4	3	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	4
Bihar	9	4	—	—	—	2	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Gujrat	10	14	10	5	1	1	—	—	—	4	4	1	—	—	9	1	—	—	—	—	6	2	—
Himachal Pradesh	4	5	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
																					(Potato+4	Simla)	
Kerala	31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	2	—
Madras	38	1	18	8	11	—	3	4	—	1	1	1	—	—	4	3	4	—	—	—	7	3	2
Madhya Pradesh	24	34	7	3	—	1	—	6	—	8	—	—	4	10	4	5	3	—	—	2	7	6	—
Maharashtra	32	16	10	2	3	—	—	1	—	2	—	1	—	—	16	4	2	5	—	8	17	—	—
Mysore	58	2	13	—	11	—	—	—	—	1	4	1	—	—	9	—	3	1	—	1	6	5	—
Orissa	31	4	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—	—	—	—	7	—
Punjab	10	10	2	2	—	3	—	—	3	5	—	3	—	1	1	—	—	1	2	—	6	6	—
Rajasthan	—	3	1	2	—	2	—	—	1	1	—	2	—	1	—	—	—	—	—	—	—	3	—
Uttar Pradesh	15	12	2	—	—	—	—	—	10	—	4	—	3	5	3	1	3	4	—	—	4	22	—
Delhi	—	3	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Jammu & Kashmir	13	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Gross	413	116	89	25	34	18	8	11	16	22	17	13	9	16	52	15	18	11	3	11	68	68	12
Net independent strains allowing for varieties grown in more than one State	379	89	85	24	31	16	8	11	16	19	17	11	9	14	37	13	17	11	2	9	47	47	11

APPENDIX IV

Important Inter-state Improved Varieties in India

Crop	Variety	States for which suited
Rice	Basmati 370	Punjab, Maharashtra, Madhya Pradesh, West Bengal.
	CH 10	Bihar, Uttar Pradesh.
	CH 45	Andhra Pradesh, Mysore.
	CH 988	Punjab, Himachal Pradesh, Kashmir.
	CH 1039	Bihar, Himachal Pradesh, Kashmir.
	Cross 2	Andhra Pradesh, Madhya Pradesh, Maharashtra.
	Cross 116	Madhya Pradesh, Maharashtra.
	E.K. 70	Gujrat, Maharashtra.
	GEB 24	Madras, Mysore, Andhra Pradesh, Kerala.
	H.R. 35	Mysore, Andhra Pradesh.
	T 21	Himachal Pradesh, Uttar Pradesh, Kashmir.
	TKM 6	Madras, Orissa.
	Mtu 19	Andhra Pradesh, Madras.
	Mtu 3	Andhra Pradesh, Mysore.
	Mtu 4	Andhra Pradesh, Mysore.
	Mtu 15	Andhra Pradesh, Mysore.
	Mtu 20	Andhra Pradesh, Mysore.
	Ptb 10	Kerala, Orissa.
	Ptb 20	Kerala, Mysore.
	Ptb 15	Kerala, Madras.
	Ptb 16	Kerala, Mysore.
	CO 3	Madras, Mysore, Kerala.
	CO 25	Madras, Mysore, Kerala.
	S.R. 26B	Orissa, West Bengal, Madras, Mysore, Andhra Pradesh, Kerala.
	F.R.13A	Bihar, West Bengal.
Jowar	M 35-1	Maharashtra, Mysore, Andhra Pradesh.
	CO-9	Madras, Mysore.
	P.J.K. 4	Maharashtra, Mysore.
Wheat	C 591	Gujrat, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, Kashmir.
	N.P. 710	West Bengal, Gujrat, Madhya Pradesh, Maharashtra, Uttar Pradesh.
	N.P. 718	Gujrat, Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan, Orissa.
	N.P. 798	Bihar, West Bengal, Uttar Pradesh, Orissa.
	N.P. 829	Himachal Pradesh, West Bengal, Uttar Pradesh
	HY 11	Maharashtra, Madhya Pradesh.
	HY 65	Gujrat, Maharashtra, Madhya Pradesh, Uttar Pradesh.
	Ridley	West Bengal, Madhya Pradesh, Uttar Pradesh.
	K. 25	Gujrat, Maharashtra, Mysore.

Crop	Variety	States for which suited
Maize	Sameri	Gujrat, Madhya Pradesh.
	U.S. 13	Himachal Pradesh, Punjab.
Ragi (Nagli)	AKP 2	Andhra Pradesh, Madras.
	CO 1	Madras, Andhra Pradesh, Mysore.
Bajra	A 1/3	Punjab, Delhi.
Mung	China	Maharashtra, Gujrat, Mysore.
Gram	Chaffa	Maharashtra, Gujrat, Mysore.
Cotton	Laxmi	Andhra Pradesh, Mysore.
	Andrews	Mysore, Andhra Pradesh, Kerala.
	MCU 1	Madras, Kerala.
	H.14	Punjab, Uttar Pradesh, Andhra Pradesh.
	H. 420	Andhra Pradesh, Mysore, Madhya Pradesh
	Buri 394	Maharashtra, Madhya Pradesh.
	Deviraj 170-CO2	Maharashtra, Andhra Pradesh, Gujrat.
	P. 216F	Punjab, Uttar Pradesh, Madras, Andhra Pradesh.
	320 F	Punjab, Uttar Pradesh.
	Gaorami 6	Maharashtra, Andhra Pradesh.
	Varnar 197/3	Maharashtra, Gujrat, Madhya Pradesh.
Safflower	No. 7	Maharashtra, Madhya Pradesh.
Niger	No. 5	Maharashtra, Madhya Pradesh.
Groundnut	TMV 1	Madras, Mysore.
	TMV 2	Madras, Mysore, Andhra Pradesh, Orissa.
	TMV 3	Madras, Mysore, Andhra Pradesh.
	AK-12-24	Maharashtra, Madhya Pradesh, Gujrat.
	Spanish Improved	Maharashtra, Mysore, Andhra Pradesh Gujrat, Orissa.
	Karad 4	Maharashtra, Gujrat.
	KO. 1	Maharashtra, Gujrat.
Sesamum	T. 85	Maharashtra, Gujrat, Andhra Pradesh.
Castor	HC. 6	Mysore, Orissa.
Sugarcane	CO. 312	Punjab, Rajasthan, Madhya Pradesh.
	CO. 313	Assam, West Bengal, Rajasthan, Uttar Pradesh.
	CO. 419	Madras, Andhra Pradesh, Mysore, Gujrat, Kerala, Orissa, Madhya Pradesh.
	CO. 421	Uttar Pradesh, Punjab, Orissa, Madhya Pradesh.
	CO. 453	Punjab, Madhya Pradesh, West Bengal.
	CO. 527	Madras, West Bengal, Andhra Pradesh, Orissa, Uttar Pradesh.
	CO. 617	Orissa, Uttar Pradesh.

APPENDIX V

Area of crops in Seed Farms required for saturation with improved seeds and area cropped in 1959-60 (*acres*)

(Total of eight States)

Crop	Area required for saturation	Approximate area cropped
Rice	7,910	5,790
Wheat	18,060	5,050
Bajra	1,700	592
Jowar	4,160	3,021
Barley	3,220	50
Ragi	475	303
Maize	470	40
Other Cereals	200	276
Total Cereals	36,195	15,122
Gram	19,410	896
Other Pulses	1,320	826
	20,730	1,722
Groundnut	8,950	1,007
Other oilseeds	500	222
Total oilseeds	9,450	1,229
Potatoes	1,480	528
Jute	970	315

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APPENDIX VI

Sufficiency of the area of Seed Farms in the Second Five Year Plan Period (acres)

State	Target of saturation of area for				Total omitting cotton	Area when fully cropped	Net area	Second Plan targets
	Cereals	Gram and pulses	Ground Nut and others	Cotton				
Himachal Pradesh	850	50	180	—	1,080	720	720	1,000
Madhya Pradesh	8,180	2,670	1,040	700	11,890	10,000	10,000	12,000
Madras	3,755	640	2,680	420	7,075	3,430	2,820	5,275
Maharashtra	6,850	4,880	2,620	2,520	14,350	8,290	9,600	13,660
Mysore	3,210	1,580	2,940	Spl. Scheme	7,730	1,620	1,520	1,600
Punjab	5,340	7,420	280	250	13,040	5,000	4,400	5,600
Rajasthan	5,180	1,540	230	120	6,950	3,870	5,700	5,700
West Bengal	2,300	1,950	1,930	—	4,730	1,500 3,000	1,500 2,497	1,500 2,500
	36,165	20,730	11,900		68,795			47,335
Andhra Pradesh	4,300	840	3,700	390	8,840			10,700
Assam	2,290	—	—	—	2,290			3,600
Bihar	9,400	4,080	—	—	13,480			11,030
Gujrat	4,110	560	2,700	1,140	7,370			9,270
Kerala	970	—	—	—	970			400
Orissa	5,210	—	120	—	5,330			4,930
Uttar Pradesh	8,550	3,870	1,140	—	13,560			16,900
Total	34,830	9,350	7,660	Spl. Scheme	51,840			56,830
Grand Total	70,995	30,080	19,560		120,635			1,04,165

APPENDIX VII

Receipts and expenditure of State Seed Farms 1959-60 (*Six States*)

State	No. of farms reporting	Total area (acres)	Cultivation charges (Rs.)	Establishment charges (Rs.)	Total recurring expenses (Rs.)	Profit or loss over			Range of profit or loss per farm (Rs.)	Profit or loss per acre over	
						Receipts (Rs.)	Cultivation expenses	Recurring expenses		Cultivation expenses	Recurring expenses
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Madhya Pradesh	19	1,284	n.a.	n.a.	5,30,571	1,25,754	n.a.	—4,04,997	1,200 to—45,000	n.a.	—260·1
Madras	55	2,810	11,55,930	2,26,283	13,82,213	14,41,952	2,86,022	59,379	43,000 to—21,900	102·1	21·3
Mysore	49	1,409	1,91,539	2,01,152	3,92,691	2,13,445	21,906	—1,79,496	7,800 to—8,850	15·3	—127·3
Maharashtra	163	7,917	7,12,090	n.a.	n.a.	8,02,618	90,528	—5,61,472	8,700 to—3,750	11·5	n.a.
Rajasthan	9	900	n.a.	n.a.	2,42,124	72,468	n.a.	—1,69,476	1,190 to—15,400	n.a.	—130·8
West Bengal	96	2,495	n.a.	n.a.	9,95,603	5,69,450	n.a.	—4,26,153	4,380 to—9,800	n.a.	—170·8
Total	391	16,815				32,25,687					

APPENDIX VIII

No. F. 14-9/61-GMF/ (Co)

GOVERNMENT OF INDIA

MINISTRY OF FOOD & AGRICULTURE
(DEPARTMENT OF AGRICULTURE)

New Delhi, the 1*st November,* 1961

FROM

Shri V. Balasubramanian,
Under Secretary to the Govt. of India.

To

The Leader, Seed Multiplication Team,
Sudarshana Guest House,
Bangalore-1.

SUBJECT :—*Report of the Seed Multiplication Team on All India—regarding.*

Sir,

I am directed to refer to your letter No. nil dated the 14th October, 1961 on the above subject and to say that this Ministry is generally in agreement with the recommendations made by the Team but detailed comments could be offered only after the examination of the recommendations in detail by the Standing Expert Committee on Seeds of this Ministry.

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Yours faithfully,

V. BALASUBRAMANIAN
Under Secretary.

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